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A Steam Tricycle.

BY ISAAC H. DAVIS.

One of the leading thoughts of engineers during the past century, or since the invention of the steam engine has been the use of steam on common roads. During this time many attempts have been made in this direction, that have not resulted in the success that could be desired. The great advantage of steam over horses is too well known to mention here, and engineers realizing this advantage are never tired of attempting the substitution of the former for the latter.

The most successful results that have been obtained in this direction are the traction engines for transporting heavy loads. These engines fulfill all that is required of them in the transportation and hauling of goods, and are in quite general use on the continent of Europe and in England. These engines are too large and clumsy for high speed, although a speed has been attained of six miles an hour with loaded wagons in India and in other places where railroads are not available.

In the construction of a steam carriage there are various things needed to make a successful machine, and it is difficult in practice to obtain good results. The greatest obstacle to success was overcome by the application of the rubber tire, in 1870, which made a practicable machine of the steam carriage. All jars or vibrations are taken up by the rubber tire, and prevented from being transmitted to the machine.

Small obstacles such as stones, etc., bed themselves in the tire, and little effort is required to force the carriage over them.

Lightness is another important requisite. This can be obtained by the use of steel in the boiler, using the boiler for the frame, and the use of high speed three cylinder engines. The lightest fuel that can be carried is petroleum. It occupies less space than coal, is only about one-half the weight, and its heating capacity is greater, and it is easier handled.

The boiler should be close to the ground, so that the machine will be steady from its center of gravity being low. The wheels should be large, as large wheels pass over obstacles easier than small ones.

In firing with oil it is easy to make an automatic arrangement to control the fire, so that the engineer can give his attention to steering the machine.

I enclose a sketch of a proposed steam carraige, which, as will be seen, consists of a steel boiler, suitably lagged with wood. The boiler is hung to the main axle by bearings. The boiler is an inclined tubular. It takes the place of framing for the engine, seat, etc., and is connected to the hind steering wheel by a steel brace.

The water tank and tool box are hung underneath. The water is fed to the boiler by an inspirator, which is operated by the left hand of the rider. By casting his eye down, the rider can see the water gauge. The steam gauge is placed on the dasher in plain sight of the rider.

In the night time the light is reflected back from the lantern through a tube which illumines the glass dial of the steam gauge. A whistle is also in front and is operated by the foot of the rider. The fire is controlled by either the foot or hand of the rider. On the right of the seat is the starting bar, which also controls the amount of steam entering the engine. On the left is the hand steering wheel. This wheel works a worm and worm gear on the single wheel behind. The engine works a train of gearing which is rendered noiseless by the use of a rawhide gear. In climbing hills, to obtain the necessary power a clutch motion changes the movement into a slow speed for the carriage, the engine making the same number of revolutions.

The fire is made from a jet of air and oil, blown into a chamber of fire clay by a jet of steam, regulated by the steam pressure of the boiler. The oil is in the holder over the steering wheel. The exhaust is rendered noiseless by passing through a perforated pipe, and is blown out underneath the carriage. The supply of water and oil will last four hours, the machine making an average of twelve miles an hour. The oil and water are then easily replaced, as they can be got anywhere.

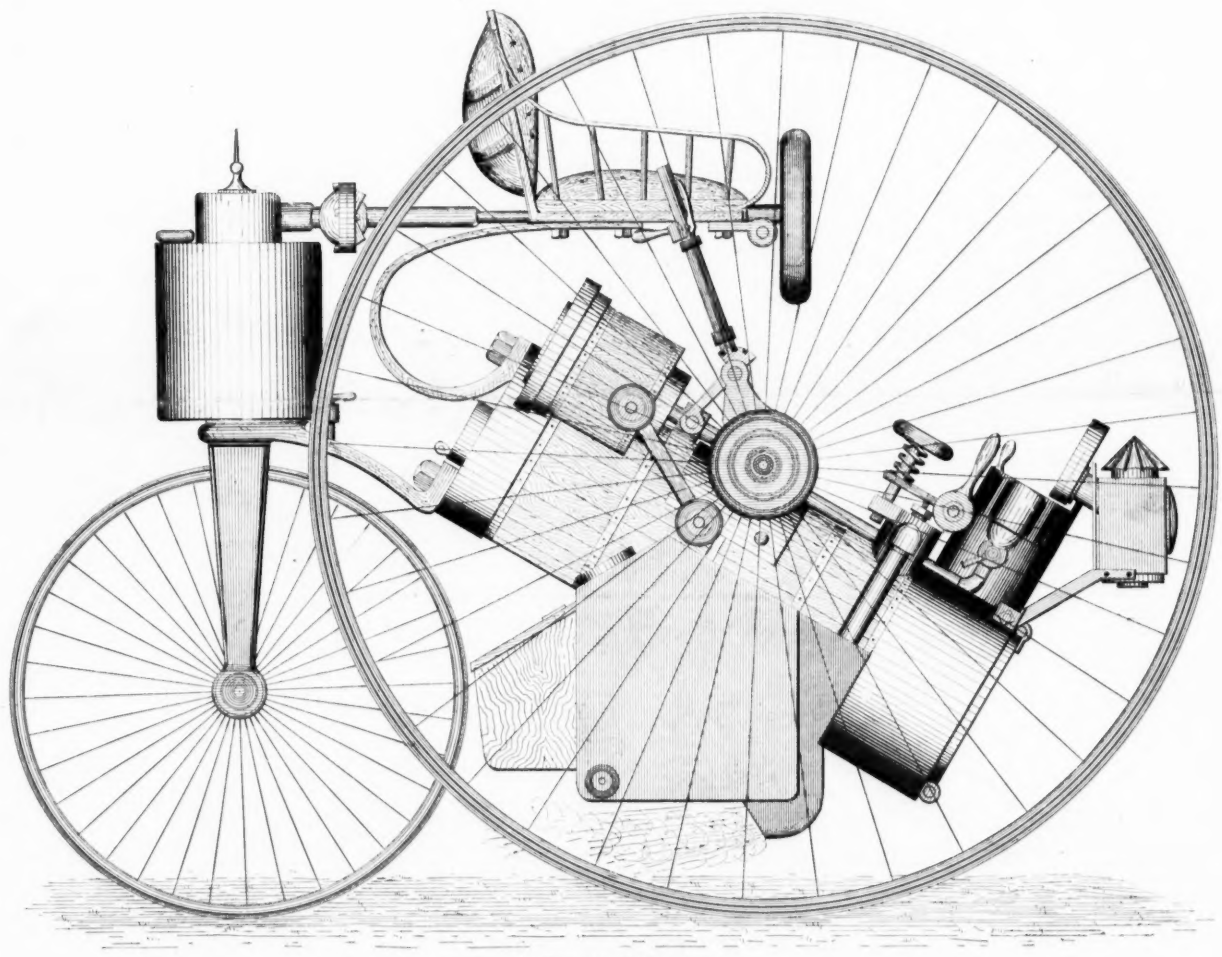
The front plate of the boiler turns down, so that the fire can be started on the usual plan (a cap taken off at the back allowing the smoke to ascend). As soon as steam is up the front plate is shut and the oil and air feed started. Nearly all the weight is borne on the large wheels, which have rubber tires, protected by a chain of sheet steel. The wheels are constructed similar to a bicycle wheel.

The engine is reversed by the starting bar. The safety valve is in front. The proportions to which the machine is built could be varied to suit the wishes of the builder. Say, for instance: Driving wheel, 5 feet; steering wheel, 2 feet 6″; width of rubber tire, 4″.

Boiler of steel, with 66 copper tubes ½″ diameter, 30″ long; shell 9½″ diameter, ⅛″ thick; weight 100 lbs; engine, 1½ horse power. Water tanks to hold one cubic foot of water; the whole weight, about 550 lbs.

This design of boiler and engine could be much reduced in proportion, less weight of oil and water could be carried and the whole vehicle made much lighter; but I think it better to make too large than too small. A proportion of 1-horse-power engine, 1¼″ boiler, with two hours' supply of oil and water, might do.

I offer this design to readers of the AMERICAN MACHINIST in hopes that it may be of advantage to some of them.



A STEAM TRICYCLE.

Description and Test of a Compound Engine.

"We lately had the opportunity of testing," says our esteemed contemporary *Engineering*, "at the works of Messrs. Manlove, Alliott, Tryer & Co., of Nottingham, a small compound engine constructed by that firm on the plans of Mr. Druitt Halpin. The results obtained were of much interest, and we propose to lay the particulars of them before our readers; before doing so, however, it will be desirable to describe the engine on which the experiments were made."

We are indebted to our contemporary for the use of the engravings of this engine (a portion of which we have the pleasure of presenting this week, and will follow with the others next week), also for the description and results of test. The whole occupies so much space that we are obliged to divide it for two consecutive issues. The Compound Stationary Engine is receiving more attention from engineers than it formerly did, and definite, well authenticated results from certain forms of construction are particularly valuable.

The general arrangement and chief constructive details of the engine are shown by the engravings. From these it will be seen that it is of the intermediate receiver type with cranks at right angles, the high and low-pressure cylinders being respectively 9 in. and 14 in. in diameter, and the stroke in both cases being 1 ft. 9 in. Referring to Figs. 1, 2 and 3, on page 3, and to the sections of cylinders, Figs. 4, 5, 6, 5*a* and 6*a* on page 2, it will be seen that the cylinders are supported by a base cast on the chamber which forms the steam jacket, a strong framing of neat and straightforward design extending from this casing and forming the cross-head guides and the plummer blocks for the crank-shaft bearings. The two arms of this frame, moreover, are connected near the cylinder end by an intermediate cross stay cast in one piece with them, this cross stay stiffening the frames, and also serving to carry the condenser and air pump, as well as the valve spindle guides. The air pump, which is vertical and single acting, is 10½ in. in diameter with 6 in. stroke, and it is driven from an arm on a rocking shaft, this shaft deriving its motion from an eccentric on the crank shaft. The rocking shaft just mentioned is also provided with another arm from which the variable cut-off motion is obtained in the manner we shall explain presently.

From the arm which works the air pump, the feed pump is also driven, this pump

being 3 in. in diameter, and having a stroke of 1.71 in.

A special feature in Mr. Halpin's engine is the arrangement adopted to secure thorough steam jacketing of both cylinders. Referring to Fig. 4 it will be seen that the casing which we have mentioned as forming the steam jacket encloses both cylinders completely, insuring the jacketing of both sides and ends. The cylinder cover joints are thus made within the casing, the latter having its own covers, which can be removed to get access to the cylinder cover joints and the pistons. The cylinder barrels and cylinder covers, moreover, are—as will be seen—provided with numerous heat ribs to facilitate the transmission of heat from the steam in the jacket. In the case of the back cylinder covers, both internal and external heat ribs are provided. The high-pressure cylinder has no valve chest, the steam being drawn from the main chamber just spoken of; in the case of the low pressure cylinder, however, a valve chest is, of course, necessary, this valve chest being connected with the exhaust passage of the high-pressure cylinder by the curved pipe of flat section shown in Figs. 4 and 5. This pipe, together with the low-pressure chest valve, constitute the intermediate receiver, and it will be noticed that they are thoroughly jacketed. The exhaust is led off from the under side of the low-pressure valve chest to the condenser through the bent pipe shown in Fig. 1. The jacket chamber, we should add, is drained by a steam trap, and the steam supply pipe gives motion to the air pump. From what we have just stated it will be readily understood that if the horizontal arm of the bell crank received no vertical motion the bell crank would simply move backwards and forwards with the main valve spindle, and as the two valve spindles would then move together, the valve would receive simply the ordinary reciprocating motion. But by the connection of the horizontal arm of the bell crank to the slotted arm on the rocking shaft a rocking motion is imparted to the bell crank, and this rocking motion is, through the upper valve spindle, communicated to the valve. The latter thus has a motion which is compounded

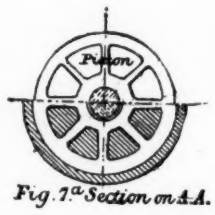
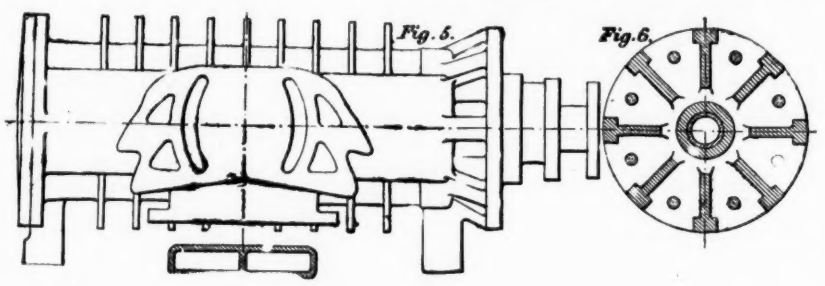
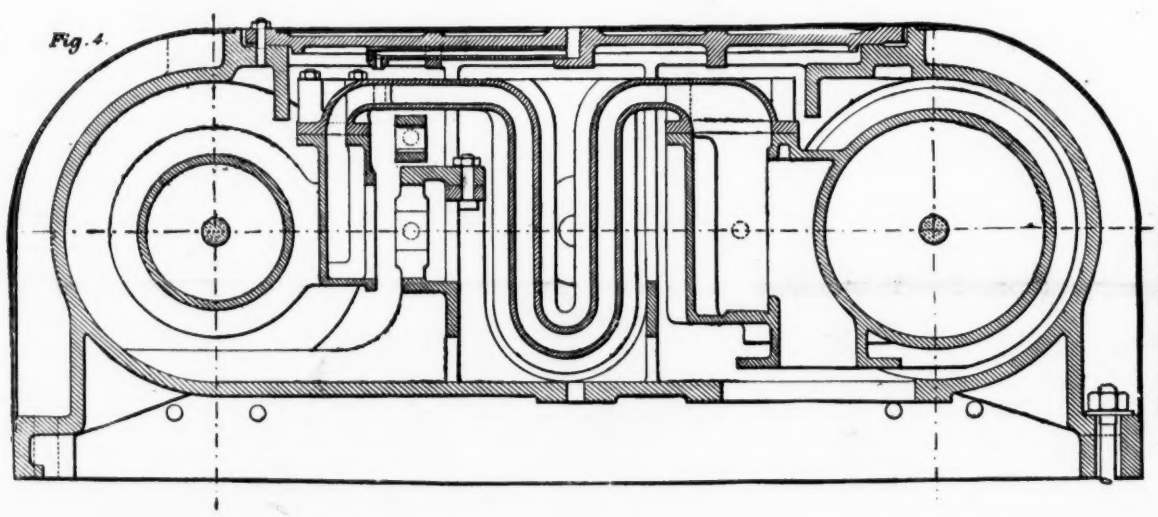
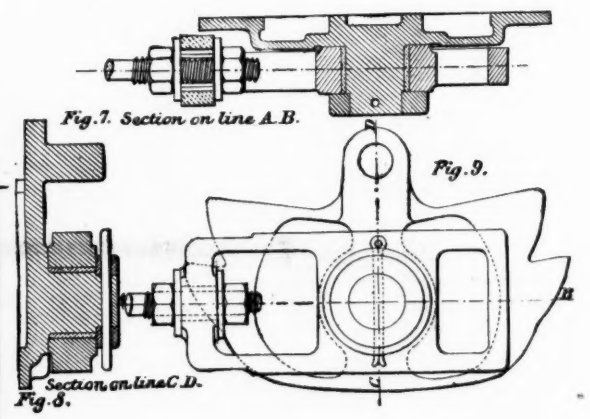


Fig. 7. Section on A.A.



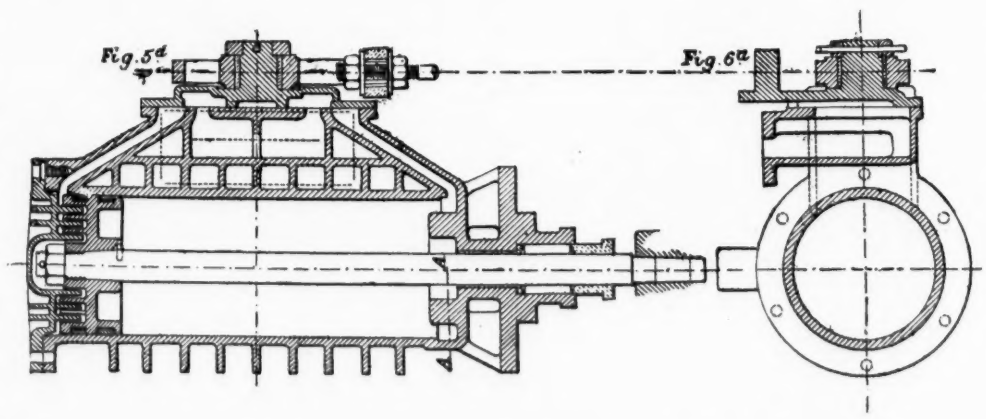




is so arranged at its junction with the chamber as to throw down to the bottom of the latter any water caused by condensation of the steam on its way to the engine.

The engine is controlled by the governor varying the cut-off in the high-pressure cylinder, this cylinder having, however, but a single valve. The requisite motion is given to this valve by a peculiar arrangement of gear patented by Mr. Halpin; this arrangement is as follows: Referring to Fig. 5, it will be seen that the ports in the valve face of the high-pressure cylinder, instead of being rectangular as usual, are of special shape, while on this face there works a valve (see Figs. 7, 8 and 9), the outside cut-off edges and internal exhaust edges of which correspond in contour to the outer edges of the steam and exhaust ports, respectively. This valve is connected to its valve spindle by a large stud cast on it at the back, as shown in Fig. 8, the connection being such that the valve while receiving the ordinary reciprocating motion from its spindle is free to be partially rotated on the stud just named.

On the upper side of the valve is formed an arm which has cast on it a second stud, and to this upper stud is attached a second valve spindle, this spindle being coupled, outside the valve chest, to the upper end of the vertical arm of a bell crank, the corner of which is pivoted to the main valve spindle, while the extremity of its horizontal arm is coupled by a link to a block sliding in the slotted arm which we have already mentioned as projecting from the rocking shaft which



of the to-and-fro of the main valve spindle and the rocking motion of the bell crank, while the amount of this latter motion, again, depends upon the position of the block in the slotted arm of the rocking shaft—a position which is controlled by the governor. The greater the amount of rocking motion imparted to the valve, the earlier is the cut-off, and *vice versa*, the proportions adopted being in fact such that when the rocking motion is greatest it entirely neutralizes the ordinary reciprocating motion of the valve, and the ports are never opened to steam at all. The governor, which is driven at a high speed, has its balls slung by links attached to the upper end of a spindle, which latter rises and falls as the balls close or open, the lower end of this spindle being pressed upwards by a weighted lever. The rising and falling spindle of the governor is connected to the block on the slotted arm of the rocking shaft by a bell crank, lever and link. The whole arrangment is very sensitive and works well, while the nature of the motion imparted to the high-pressure valve is such as to greatly promote the maintenance of a good surface. The low pressure valve is of the ordinary pattern driven from an eccentric in the usual way. Apart from the construction of the cylinders and valve gear, which are its most striking features, there are several details of the engine worth special notice. Thus the cross-head blocks and guide bars are proportioned on the principle pointed out by Professor Sweet, of Syracuse, New York, the cross-head blocks being very long—equal to the stroke—and the wearing surfaces of the guides (which are bored) being of the same length.

(*Concluded Next Week.*)

The American Institute of Mining Engineers will hold its next meeting at Denver, Colorado, beginning Monday, August 21st. The members are expected to spend a week or ten days in the State. A large number of papers are expected to be read at the meeting.

Built-Up vs. Solid Work in Engine Construction.

DISCUSSION ON HORACE SEE'S PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Mr. See explained the superiority of built-up work over solid work in strength, lightness and economy, and said that the former could be forged in one-half the time required for the latter.

WILLIAM KENT said that he had heard it stated that the facilities for making cranks and crank shafts would limit the size of engines, and that the limit had been about reached; but that he thought the paper of Mr. See had pointed out one possible line of development—the use of built-up pieces instead of solid pieces. He concluded by making the inquiry of Mr. See whether steel could be used in place of iron.

MR. SEE: There is one advantage resulting from the built-up system. In the crank shaft, for instance, we can make it of iron or steel. We can put whatever material we choose into the construction of the crank shafts, or we can divide them up. Crank pins have been made of steel.

MR. KENT thought that the tendency of the built-up system would be to replace hammering by the use of the hydraulic press in the making of machinery. He said that hammering would develop any flaw that existed in a piece of metal into a large hole.

PROF. THURSTON: I do not know precisely what is the phenomenon that occurs in the enlargement caused by light hammering, but I know it does occur. I have seen large shafts broken to pieces in that way. I believe eventually the hydraulic press will be used. I do not know how hard a steel can be used, but I see no reason why ultimately true steel can not be employed There are ways now of hardening large masses of steel. I see no reason to expect that any limit to the size of the parts of a machine will be found within any early period, and I believe if we have any occasion to build ships twice as large as the Great Eastern that we will find a way to construct the parts of the machinery required, and to run it without any special difficulty.

The Government method prescribed for cleaning brass, and in use at all the United States arsenals, is claimed to be the best in the world. The plan is to make a mixture of one part common nitric acid and one-half part sulphuric acid in a stone jar, having also ready a pail of fresh water and a box of sawdust. The articles to be treated are dipped into the acid, then removed into the water, and finally rubbed with sawdust. This immediately changes them to a brilliant color. If the brass has become greasy, it is first dipped in a strong solution of potash and soda in warm water; this cuts the grease, so that the acid has free power to act.

Master Mechanics and Master Car Builders Associations.

The American Railway Master Mechanics Association, will hold their next annual convention at Niagara Falls, June 20, 1882. The following subjects will be reported upon an discussed:

Improvements in boiler construction; The best material and form of construction for parallel rods of locomotives to prevent their breaking; New plans of construction and improvement of locomotive engines; The most practicable and best system of paying premiums to locomotive engineers and firemen to induce economy in working locomotives; report of standard wire gauge committee, on a suitable standard wire gauge for adoption; smoke stacks and spark arresters.

This society has a custom of having two of the associate members read papers at each of the annual meetings. At the next meeting the following associate members will read papers: P. H. Dudley, Cleveland, O., and Prof. Henry Morton, Stevens Institute, Hoboken, N. J.

Preparations are being made to render the convention at Niagara Falls more than usually interesting.

The Master Car Builders' Association will hold their next annual convention in Philadelphia, Pa., June 13, 1882.

This meeting it is expected will be important on account of the discussion of very practical subjects in which all railroad men are interested. At the last annual meeting of this association a committee was appointed to obtain information with reference to the carrying capacity of freight cars and to get the opinion of various railway officers, as to the advisability of increasing that of freight cars above twenty tons. It is only a few years since freight cars were allowed to be loaded with more than ten tons. At the present time but few eight wheel cars are built with a carrying capacity of less than twenty tons. From this fact it is inferred that twenty-ton cars can be run as safely as the ten-ton cars and that freight can be transported with greater economy in cars having the greatest carrying capacity. The enlarging of freight cars has been found a necessity both for economy and owing to the rapid increase in the freight traffic

Locomotives are being built of greater weight than ever, the latest being of over 120,400 pounds, and it is natural that the carrying capacity of cars should follow.

The Master Car Builders have sent out a circular of inquiry to all the leading, as well as all roads from whom an opinion would be likely to aid in settling the above question. This circular contains the following questions: 1. Have you found any difference in the breakage of wheels under ten or twenty-ton cars? 2. Are the wheels under your twenty-ton cars of greater weight than under ten-ton cars? If not, do you think they should be? 3. Have you found any difference in the wear of journal bearings upon ten and twenty-ton cars? 4. Have you found that journals under twenty-ton cars wear out faster than under ten-ton cars? 5. Have you had more hot boxes under twenty-ton cars than ten-ton cars? 6. Have you found it necessary to use more expensive oil upon twenty-ton than upon ten-ton cars? 7. Have repairs to draw bars and fixtures and other repairs under twenty-ton cars been greater than to ten-ton cars? 8. Do the bodies of twenty-ton cars show a greater deflection from their original lines than ten-ton cars? 9. Have the twenty-ton cars increased the repairs to road bed, rails or bridges? 10. In your opinion, can freight cars of 34 and 40 feet in length be run as safely as shorter cars? 11. In your opinion, can the carrying capacity of freight cars be increased from 20 to 25, or more tons, with greater economy than to carry freight in twenty-ton cars? 12. If the carrying capacity of freight cars should be increased to 30 tons, would you recommend journals and axles to be made larger than the Master Car Builders' standard, and that the wheels be increased in weight? 13. Can a locomotive draw 1,000 tons of freight over your road in twenty-ton cars with greater economy than in ten-ton cars?

FIG. 1

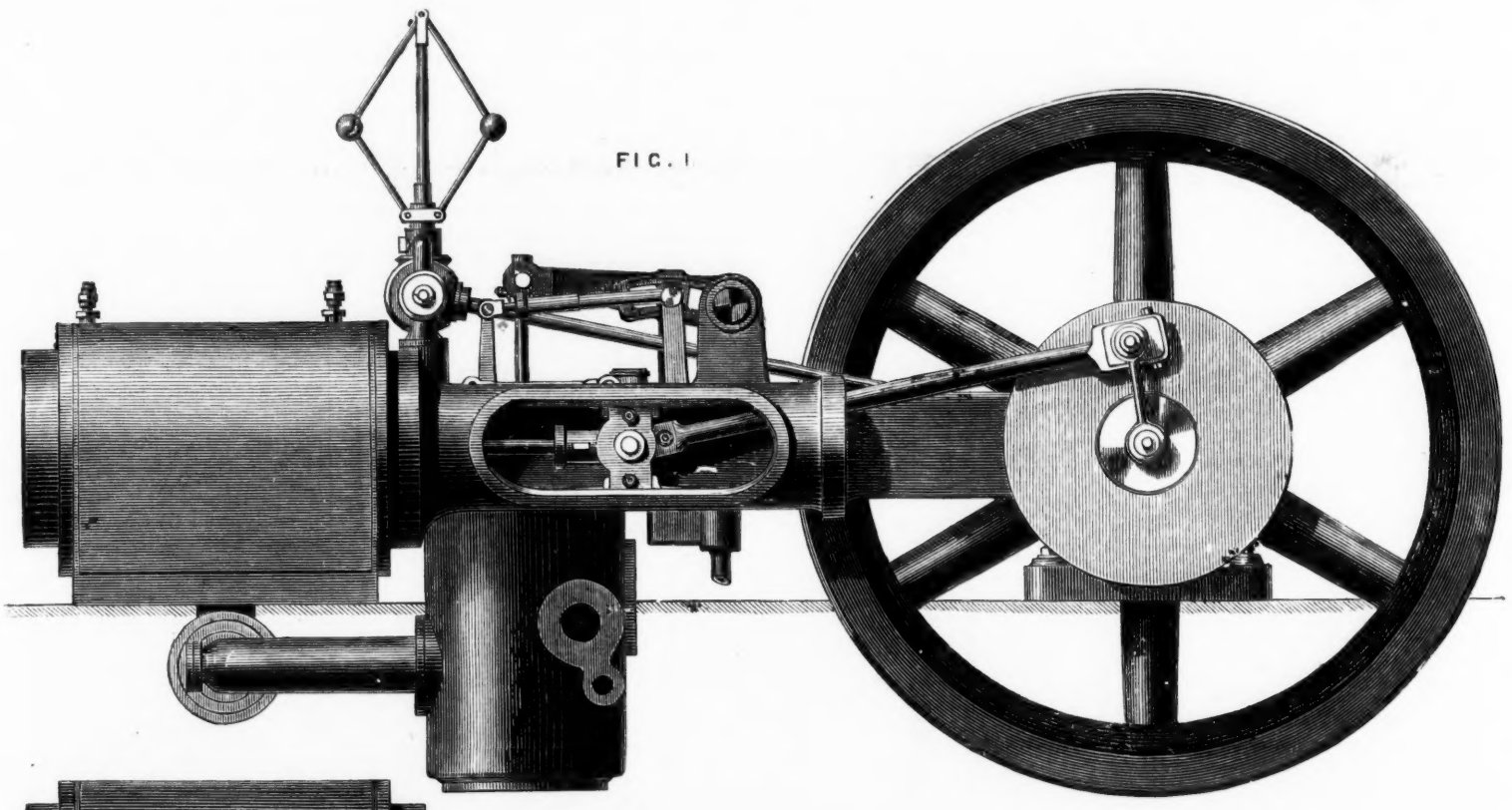
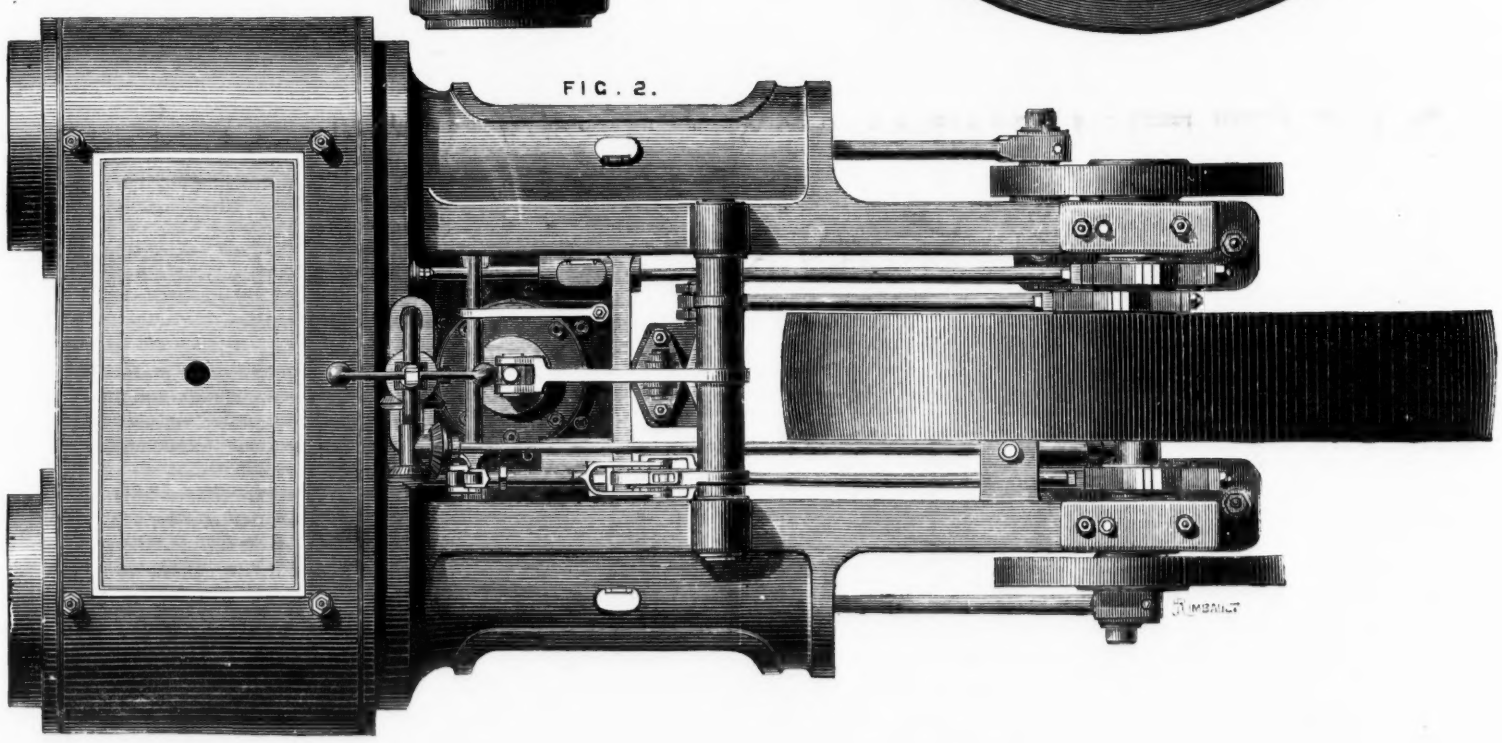
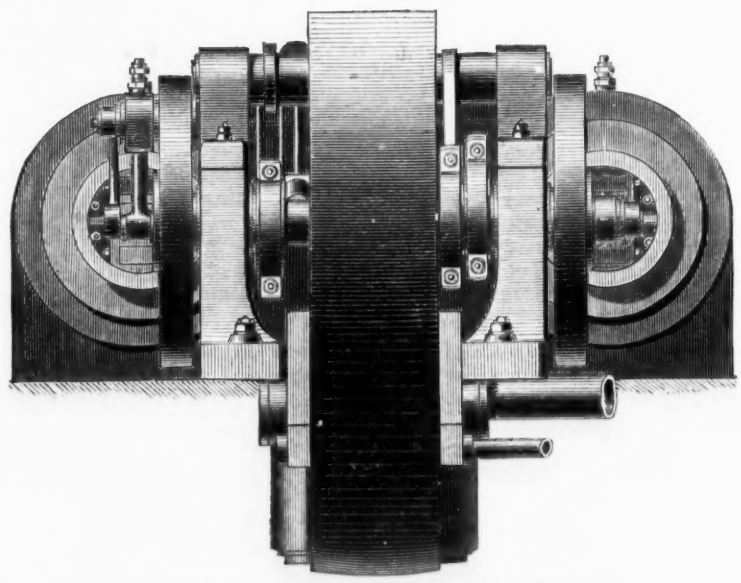


FIG. 2.





HALPIN'S COMPOUND ENGINE.—FIG. 3.—(See page 1).

The replies to this circular have been very large thus far.

To find the capacity of a circular tank: Multiply the square of the diameter in feet, or decimals of a foot, by 5.874; the product will be the capacity in gallons for each foot in depth.

An engineer who communicates the above says he don't know how novel it is, but he can vouch for its quality of being handy.

We have received from Wm. T. Ross, Louisville, Ky., a Table of Pitch Lines of Toothed Wheels, from ½ inch to 4 inches pitch, and from 12 to 100 teeth. From this table the diameter of any wheel may be obtained very easily and with very few figures. The table has been constructed from a rule which accompanies the table. To make it still more plain a number of examples have been worked out as illustrations of how it works in practice. A table illustrating the Manchester principle has also been given.

Economy in the Management of Foundries.

BY THOMAS D. WEST.

Whatever knowledge there is on the subject of melting iron has, for the most part, been obtained from individual investigation and practice, and the possessor, in most instances, holds it a secret in order to create a demand for his services. Men who do this can be found connected with all trades and professions, their lack of knowledge being hidden under silence and a wise look.

It is by asking questions that we all have gained the most of our knowledge. Truthful writings of our practice and our knowledge on any subject, is about the same thing as asking and answering questions, that is, when our writings are open to criticism.

The difference is that it is not practicable to enter so fully into particulars when writing as may be done in conversation.

If in my writing there should appear any wrong statements, or an ignorance on my part, I shall be glad to have them noticed, and will take all just criticism kindly, as I am glad to see that there are others than myself that are not afraid to give some of their own experience, and odd ways and workings of the foundry cupola, from fear of being criticised.

Mr. Wishart has been making a test heat in a cupola that is only 24″ at the bottom and 21″ at the charging door. This shows the cupola to have a taper of 3″ in the length of 8 feet, which is a very good plan for small cupolas, as the stock has a chance to free itself as it comes down, thereby lessening the danger of having the cupola bung or hang up, which is a great fault with small cupolas. In getting his cupola ready, he has taken extra care and caution. In relation to daubing up his cupola, he could remedy matters by blacking it over the same as a loam moulder would do when he wanted his loam to peel off a heavy casting. His plan of putting up the bottom twice, and having a second fire is one that very few foundries could adopt, as it wastes too much time. In the majority of foundries it is about all the cupola man can do to get ready with only once putting up the bottom.

Mr. Wishart says he melted 3,800 pounds (not quite two tons) of iron in 40 minutes, with 310 pounds of coke and 100 pounds of coal, but he does not claim this to be a safe working quantity of fuel. There seems to be one point that he made himself safe on, and that is the amount of iron he melted. I think if Mr. Wishart had tried to melt about three more such charges, charged up in the same manner as his last one was, which would then have made his heat 6,350 pounds, only a little over three tons, an amount that such a cupola should melt readily, in the morning when his employers came around, they would forget all about the coal bank and ask him if he was going to start a scrap warehouse.

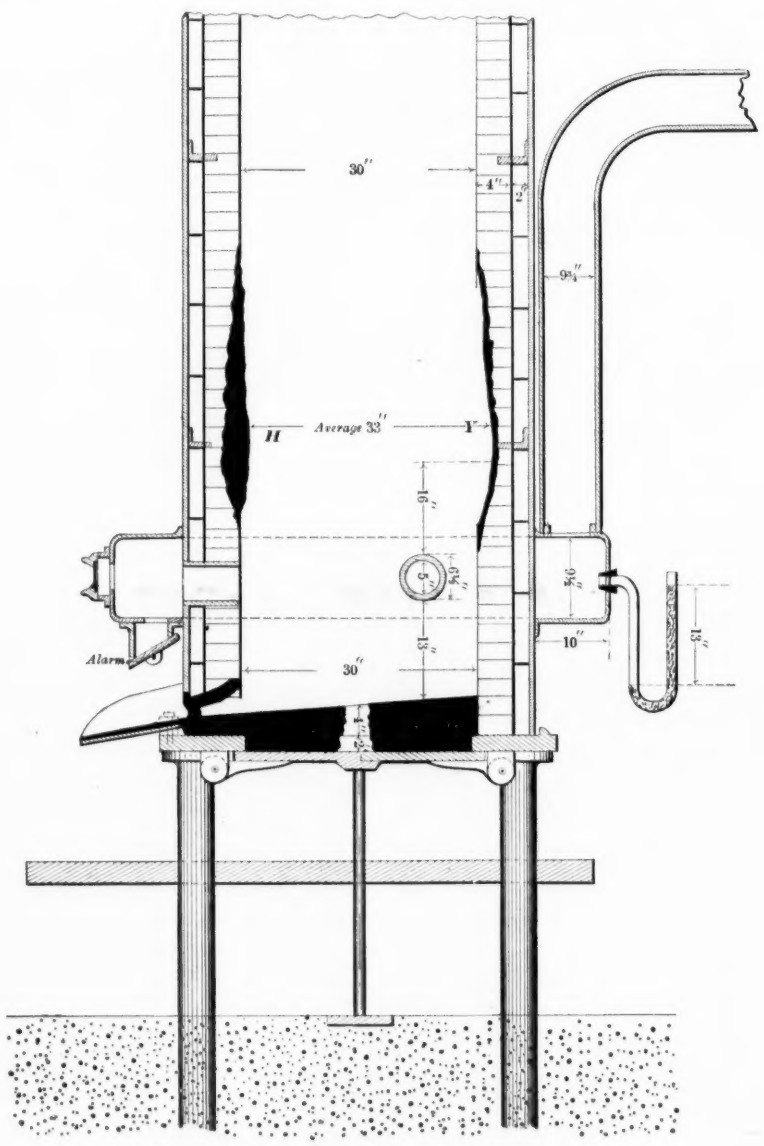
Mr. Wishart says again that if I would attend to a few heats myself, I would have better results. A foreman of a busy jobbing foundry has something of more importance to do during casting time than to be throwing iron into a cupola. It is his place to give orders, and to see and know that they are obeyed; not to do the work and have half a dozen men standing looking at him. Mr. Wishart, a little farther down the column, seems to express the idea that I make a practice of having every heat charged up with the fuel in the middle. I should like to have him show where I made such a statement. I said that it might have been done, but it was not till Mr. Kirk said that it was impracticable and could not be done, that I gave the result of one heat in the manner described. The weights of coke and iron are given with exactness, and the result of the heat is one that I think is acknowledged to be in accordance with the title of the article "Fast Melting." The only objection that my critic has against this plan of melting is, that there was more coke used than should have been used according to his figuring, and therefore he has entitled his article "Economy in Melting." This looks well in print, and sounds fine, but it puts me in mind of that old maxim "Penny wise and Pound foolish." I have seen this economy of fuel make heavy losses in bad castings, bunged up cupolas, ladles full of frozen iron, so that they could not be used, iron poured all over the foundry floor, and enough wasted to buy a carload of coke or coal. There is nothing so annoying and so expensive, as to be handling melted iron that has no life to it, and any foreman that will save a dollar or two in fuel at the risk of having as many hundred dollars worth of castings lost, is not only setting fire to his employers residence (as Mr. Wishart terms it), but is digging a grave to bury him in. Mr. Wishart's figures of 7 to 7½ pounds of iron melted for every pound of fuel is correct enough, but his writing is not broad enough and would carry the impression that all cupolas could be run the same as the one he writes about. To commence with his use of the word *fuel* would indicate that it made no difference whether it was *coal* or *coke*. Again there is no allowance for grades of light or heavy iron, the amount the cupola is to melt, or the height of tuyeres, four very essential points that have to be considered by a melter or foreman when he goes to charge up a new cupola. I claim that a consideration of these points indicates why some cupolas require more coal or coke than others, to melt iron with. There are other features or conditions upon which I will not dwell. I believe that melters who have used coal and coke to melt iron with, will bear me out in the above statements, and also in the statement that heavy iron requires a higher bed, with more fuel between the charges of iron, than a light grade of iron.

Again, when a cupola has to melt a large heat, there is more fuel required between the charges and on the bed than when only a light heat is to be melted. The height of tuyeres is a point that no man used to a cupola would dispute. In reading Mr. Wishart's letter, I see that in figuring up the height of his tuyeres and that of mine (to the top of the tuyeres), there is a difference of 7″ which causes me to use 7″ more fuel than he uses, as the height of fuel in any cupola must be up to the top of the tuyeres before there can be economy in the use of fuel. In the heat criticized, there was, as stated, 455 pounds for a bed, 240 pounds of which was required to bring the coke up to the top of the tuyeres. On top of this there was 215 pounds of coke. This made the bed for the first charge of iron. The rest of the charges were as stated, with the exception that I omitted to state that for the last charge of iron there was no coke used, as the amount of coke on the bed was sufficient to melt it. This is a practice that I follow every day, because I know that by so doing, the cupola man has not so much half-burnt coke to pick out from the bottom in the mornings; also the last charge is melted quicker from not having to wait for the combustion of a charge of fuel under it, and as there is plenty on the bed it is not required.

There is one point that I wish my critic to understand. That is, that in writing this article I am not trying to make any excuse for my extravagance in the use of fuel, as he calls it, but intend to show that the amount or percentage of fuel that is used for one cupola will not answer for all others. Such economy of fuel as Mr. Wishart gives is no economy at all, for, as he admits, it is not practical. Should jobbing foundries attempt his practice, they would be bankrupt in a short time.

Again, I claim that to work a cupola on all classes of iron, where there are not two heats but that the mixtures are changed more or less, there is more money made, and the economy is better for a liberal use of fuel than by being too short, which, sometime or other, is sure to result in the loss of castings. It does not take many bad castings to balance a dollar or two in fuel.

Mr. Wishart says that if I will put my coke directly under the iron, in place of building the iron around the coke, I will have as good a result with 1,150 pounds of coke as I did have with 1,430 pounds (which should read 1,365 pounds). Figuring as he does, he must allow me about 75 pounds of coke that, were my tuyeres as low as his, I would not have had to use. This, deducted from 1,365 pounds, leaves 1,270 pounds; and, instead of wasting 280 pounds, it is 120 pounds. When he considers that my first two charges were all pig iron, and that the balance was 200 of pig iron and 300 of scrap iron, by no means a light grade, and that when melted the iron was required to be hot, I think he will say that the explanation alters the case, and that I am not so far off, considering that I was not running an experimental heat to see how little fuel I could use at a risk of bunging up the cupola, or losing the price of two or three tons of coke by having dull iron. I wish Mr. Wishart to understand that I do not use any more coke when charging up with a hole in the middle than I do when having my iron covered all over with the coke. If there be any fault, it must be that I do not understand my business, or that I use too much caution to insure four tons of good, sound castings, at the expense of having used a little extra coke. To use too much fuel is as much of a hindrance to fast and good melting as to use too little.



CUPOLA WITH MELTING PORTION DAUBED UP.

Mr. Wishart's plan of daubing up his cupola is a good one, provided the time can be spared to do it. I will give some of my ideas on this subject.

In looking at the cut shown herewith, there is seen one side of the melting portion daubed up, so as to fill up all this burned or melting surface even with the upper and lower parts. This is one cause for cupolas getting bunged up before they have run half of the heat off that they would if daubed up as shown on the opposite side, at *Y*. Too much clay daubed on the lining will only bag down, as shown at *H*, and make it too heavy to hang on the lining or bricks. When the blast is put on, the commotion of the fuel and iron against it will soon start and cause it to come away from the lining and mix in with the fuel and iron so as to cause a large amount of slag. It will also form a bridge over the tuyeres, thereby preventing the blast from getting into or among the fuel. When this daubing falls off the iron and fuel will get in over the bridge, and cool and chill so as to soon bung up the cupola, and stop the melting. To properly daub up a cupola there should not be more than one inch of clay over the surface, and when the lining is burned out in spots there should be some pieces of fire brick built in with the clay, to save having large lumps of wet clay to dry and to cause trouble when the blast goes on. The melter should be very careful in mixing his clay to have just the right quantity of open or sharp sand mixed in with it, as too little causes the clay when drying to crack open, and too much destroys the body of the clay.

Again, the picking out of a cupola is an essential matter. A melter should never pick off the cinders, slag, or clogged iron so as to disturb or crumble the face of the bricks. If there can be left on the face of the brick the glossy skin or cinder formed by the heat, it will often stand the fire and blast better than some clays that are used.

The best clay for daubing is fire clay. When the melting point or surface is so badly burned out that from ½ to 1 inch thickness of clay will not keep the iron shell from getting red hot, that portion of the cupola should be re-lined at once.

In the same issue of the MACHINIST in which Mr. Wishart criticized me, some one who signed himself "R," desired me to state the pressure in ounces per square inch that produced the blast; also how the blast, was driven, and at what speed, the size of the pipes, height of tuyeres from the bottom, and what was the shape of the cupola. If this gentleman will look at the drawing of the cupola which I made mostly for his benefit, he will see that my tuyeres are 5 inches in diameter, and about 23½ inches from the top of the bottom plate up to the top of the tuyeres, of which there are three (two only being shown). The glass siphon having a cork on one end was inserted in a hole made in the wind box, as shown, and the pressure of the blast held up a column of water varying from 13 to 14 inches, which would make a pressure of about 7½ ounces per square inch. The length of the conducting pipe from the fan is about 90 feet, in which there

are six elbows or bends. The fan is driven by belts. The size of fan is 45 inches. It supplies blast for the large as well as for the small cupola. The engine is called 16-horse power, and runs a large boiler shop besides driving the fan. The speed of the fan is 2400. The cut of this cupola is also given, in order that any one may criticise it and show what they think, or know by experience, to be better.

New Machinists' Bench Lathe.

There are numerous lathes in the market that are capable of turning out work with fair degrees of accuracy, but for the finest kind of work, as for experimental machinery, watch and clock work, special tools become necessary. The lathe shown in the accompanying engraving was designed particularly to do the finest and most accurate work.

The lathe bed is supported at each end, as shown. The top of the bed is scraped all over. Both head and tail stocks are bored to fit a mandrel upon which they are planed to a standard gauge, thus insuring perfect interchangeability and alignment in all lathes of this class.

The live spindle is of steel, hollow, hardened and ground to correct bearings both inside and out.

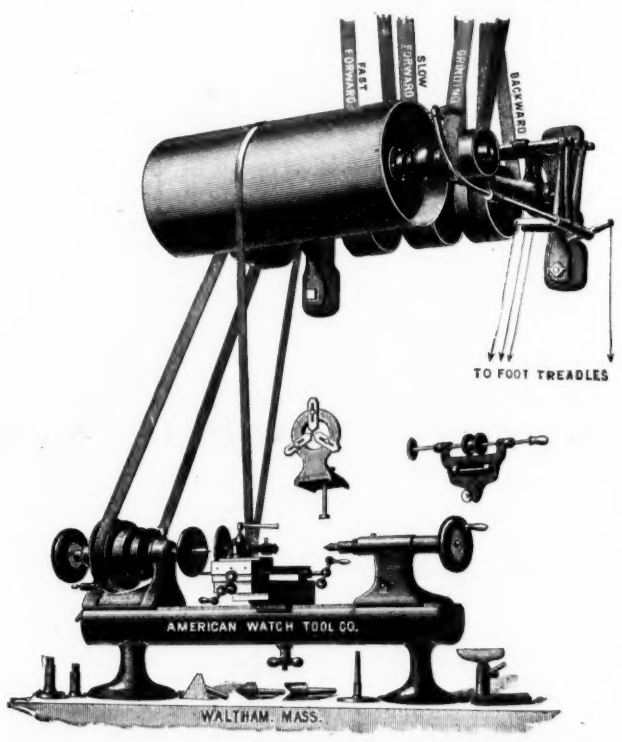
The bearings are made with two tapers which approximate to the shape of the antifriction curve, and are therefore of the best design for durability and retaining their accuracy. The steel bushings are also hardened and ground. The spindle is fitted up for using self-centering spring chucks for holding wire, while extra spring chucks of special forms can be furnished for holding all shapes, however intricate, as in watch and other special kinds of work. With these spring chucks a piece, or a number of small pieces of material can be chucked with precision and released instantly. The spring wire chucks for this lathe are made of steel hardened and ground true for taking in wire from 1 centimeter ($\frac{3}{8}''$) in diameter down to 1 millimeter ($\frac{1}{32}''$).

Besides the chucks alluded to, other scroll, or independent jawed chucks found in the market may be readily adapted to this lathe. The tapers for the common live and dead centers are ground to a standard size, so that duplicate centers can be furnished which are sure to fit and run exactly true. This lathe is provided with a compound slide rest for metal turning. By removing the slide holding the tool post, an emery grinder may be attached, as shown in the engraving, for various kinds of straight or angular grinding.

A special grinder, shown over the tail stock, for very small, fine work is also furnished when desired. These grinding devices are used for either internal or external grinding, and are accurately graduated into degrees so as to be set at all angles, so that almost any piece of work can be turned, then hardened and ground true. As will be seen from the engraving, this lathe is intended to set upon a bench with the counter shafts attached to the wall. The driving counter has three belts, two of which are for forward movements, driving pulleys of different sizes, which by the aid of the cones gives the advantages of six different speeds, which is a great advantage in cutting screws with dies. The other belt is for running backward. The drum counter shaft, located directly over the lathe, is for driving the grinding attachments described, or cutters for cutting gears, which may be driven with an open, crossed, or quarter turn belt.

In cutting gears, an index plate is placed upon the back end of the live spindle and the gears are held in the place of a face plate. Either spur or beveled wheels may be cut equally well upon this lathe, thus making a gear cutting machine of a lathe.

The driving belts are each connected with treadles under the bench to be operated by the foot of the workman. When desired this lathe can be provided with a foot power and placed upon a special bench having a number of convenient drawers for tools and small work. This machine was designed by Ambrose Webster, and is made by the American Watch Tool Co., Waltham, Mass.



NEW MACHINISTS' BENCH LATHE.

Disputed Announcements Verified.

We have examined the inclosures mentioned in the letter below and find them just as therein set forth as far as press copies of letters can show. The evidence seems to show that the information which Mr. Grimshaw handed us, and which we published some weeks ago, relating to gear standards and an engineering expert office was correct. With this we dismiss the subject, as we have no room in these columns for personal quarrels:

Editor American Machinist:

Mr. J. W. Nystrom's statements published in your issue of May 6 are received to-day.

In reference to the Mechanical Engineering Section of the Franklin Institute, I hand you:

(*A*) Printed phonographic report in *Paper Trade Journal*, April 1, of the proceedings of the March meeting, in which it was understood that the Secretary had been collecting and was to continue collecting gearing data. Such work is a part of the duties of the Secretaryship, and requires no special vote or authorization.

To refute Mr. N.'s denial of any connection with these expert offices, I inclose you the following documents, not for publication, but to enable you to state to the public whether or not I am correct:

(*B*) July 1, 1881. R. G.'s tender of engagement to J. W. N. in stated terms (press copy).

(*C*) July 2, 1881. J. W. N.'s acceptance (original).

(*D*) July 11, 1881. Tender of services, engine case (press copy).

(*E*) July 12, 1881. J. W. N.'s signed report in same (original).

(*F*) July 29, 1881. R. G. to J. W. N. about Cincinnati Engine tests (press copy). Mr. N.'s report to me on this subject was made public last year.

(*G*) Oct. 4. R. G., tender of services, 60 H. P. feed heater test (press copy).

(*H*) Oct. 5. J. W. N.'s acceptance (original).

(*I*) Nov. 8. One of J. W. N.'s receipts in full of all demands to date for services (original).

(*K*) Nov. 5. Same, another member of the board (original).

(*L*) Nov. 23. Nine-page report to N—— Paper C, tests of paper rolls, signed R. Grimshaw and J. W. Nystrom (press copy).

(*M*) Nov. 25. Signed opinion, same case, R. Grimshaw and J. W. Nystrom (press copy).

(*N*) J. W. N.'s receipt in full of all demands to date for services in above case (original).

(*O*) Jan. 10, 1882. R. G. to J. W. N. requesting figures on drawings, universal joint coupling (press copy).

(*P*) Jan. 11. J. W. N.'s estimate in reply to above (original).

The signed reports (*L.*), (*M.*) and most of my letters to Mr. Nystrom are on letterheads similar to the one on which I write, and on which his name appears (as you will see) as "associate consulting engineer."

I have nothing more to say, except to ask you to publish this letter exactly as received, with a statement from you as to authenticity of documents. ROBERT GRIMSHAW.

Philadelphia, April 26, 1882.

Essentials in Mill Construction.

The Boston Manufacturers' Mutual Fire Insurance Co. has issued a special report on mill construction with a number of neat diagrams. We make some random extracts; the first being conclusions reached by Prof. G. Lanza in a series of tests of wooden posts upon the Emery Testing machine, at the Watertown Arsenal. The professor found that the crushing strength per square inch varies very considerably in specimens of different degrees of seasoning, also in large and small specimens, also that the average crushing strength of wood is much less than has been supposed by many. That of some very highly seasoned hard pine was found at the arsenal to be 7,386 pounds. For some hard pine of very slow growth and very highly seasoned an average crushing strength was found of 9,339 pounds. For some very wet and green they found a crushing strength of 3,015 pounds. For some yellow pine which had been seasoning about three months he found 5,400 pounds. For average crushing strength of such posts as he tested, not thoroughly seasoned, and not very green, he found about 4,400 pounds, whereas in none of these cases did he obtain a greater result than about 4,700 pounds. Hence it would be entirely unfair to assume a crushing strength of 8,000 pounds for yellow pine.

* * * * *

The facts developed by this series of trials of the weight required to crush or cripple wooden columns, have led to the following conclusions:

1st. That it is a mistake to turn wooden columns to a taper when worked from square timber, or even to turn them at all.

2d. That a square column is much stronger, cheaper and better, provided there is no objection to the form. The objection to the danger of abrading the corners (which may be chamfered off) by contact with trucks can be avoided by metal guards at the base.

3d. That the direct vertical stress to which a column may be subjected without injury is less than has been very commonly assumed; hence the factor of safety in columns in use is less than has been supposed.

4th. That accuracy of fitting and placing is an item of great consequence, inasmuch as badly fitted caps and pintles greatly reduce the strength of columns.

* * * * *

In the course of this investigation, attention has been drawn to the whole subject of constructing a frame for a textile factory, machine shop, or other similar purpose, and we have been led, *as underwriters*, to consider the present methods defective in many respects.

* * * * *

The objective points of a plan submitted are as follows:

1st. To construct the timber frame and floors of a mill in such manner that the frame will stand firmly by itself, as to every part, until each section is successively destroyed or wholly burned by fire.

2d. That any of the posts or any of the beams upon which machinery directly rests may be broken or burned, and may fall out of their respective positions with a section of floor, but without bringing down adjacent parts as yet uninjured by the fire.

* * * * *

The question of using iron posts in place of wood is not treated On the whole, the jndgment of the underwriter favors the wooden post of sufficient size. If the side line of posts are covered, as suggested, with wire lath and plastering above and metal below, great care must be taken to provide for the interior ventilation of the post lest dry rot should ensue. Common lime plastering will not exclude the air from the wood; but if a finished coat of calcined plaster is also used, the danger of dry-rot will be incurred unless provision for ventilation is made.

* * * * *

In the several papers submitted upon mill and storehouse construction, our conclusions have steadily tended towards the use of brick, rather than stone of any kind, or iron, as the material to be used in piers and walls, and to the use of plank and timber for interior work, so disposed that ample time may be given to extinguish a fire in any room before it can make its way from one room to another; we also express a preference for plastering upon wire lathing for the protection of ceilings or other surfaces of wood rather than sheet metals, except, of course, in the case of doors or shutters, which can be completely encased in tin.

* * * * *

We advocate the low, broad factory, as underwriters, because our observation has been that the spread of a fire can be successfully resisted upon a horizontal plane for a long time, while it becomes difficult to resist as it passes from floor to floor, but there are many reasons for adopting this plan irrespective of the danger of fire; not among the least of these reasons is the saving of the vital force of women and children. If operatives be considered economically, without any regard to considerations of humanity, there is no doubt that women and children can work better day by day, and can also work more years, if they are saved the exertion of mounting long flights of stairs, and are free from the vibration which affects mills of many stories in height.

* * * * *

A door of the right construction to resist fire should be made of good pine, and should be of two or more thicknesses of matched boards nailed across each other, either at right angles or at forty-five degrees. If the doorway be more than seven feet by four feet, it would be better to use three thicknesses of same stuff; in other words, the door should be of a thickness proportioned to its area. Such a door should always be made to shut into a rabbet, or flush with the wall, when practicable; or, if it is a sliding door, then it should be made to shut into or behind a jamb, which would press it up against the wall. The door and its jambs, if of wood, should then be sheathed with tin, the plates being locked at joints and securely nailed under the locking with nails at least one inch long. No air spaces should be left in a door by panelling or otherwise, as the door will resist best that has the most solid material in it.

* * * * *

In the paper read by Prof. Lanza, at the Philadelphia meeting of the American Society of Mechanical Engineers, "Strength of Wooden Columns," the fact was made apparent, as the results of his tests at the Watertown arsenal, that in columns of 8″ to 10″ in diameter and up to 12 feet long, the length had no influence on their resistance to crushing stress.

LETTERS FROM PRACTICAL MEN.

Too Many Tapers on Gas Pipe.

Editor American Machinist:

Being a constant reader of your valuable paper, I saw in your last issue a few remarks on pipe thread and pipe-tap tapers, by "Greaser." Now, according to Greaser's account he has got pretty well mixed on the pipe-taper business. I think I can explain matters to him a little. In the first place, the standard taper for all pipe is $\frac{1}{4}''$ to the foot. About pipe which he says isn't over $\frac{3}{8}''$, if Greaser will investigate a little further he will find that the taper of pipes will vary from $\frac{1}{8}''$ to $\frac{3}{8}''$ to the foot, for which the manufacturers are responsible. In the first place, their dies are not made to a uniform taper, and they are used after they get badly worn.

Lorain, Ohio. E. C. BARTLETT.

Standard Pipe and Pipe Tap Taper.

Editor American Machinist:

Noticing in your valuable journal the question of standard taper of gas and steam pipe taps, allow me to make a correction.

The Pratt & Whitney Co. refer to R. Briggs, C. E., of Philadelphia, as the originator of the standard in 1862, which is incorrect. In 1850, when an apprentice at 79 John street, N. Y., the standard was $\frac{3}{4}''$ to the foot. Hobs, or master taps, then used for dies, were $\frac{3}{4}''$ to the foot, and were supplied to us by the Providence Tool Co. I cannot say at what date previous to this the taper was established. JOHN FINNEGAN.

Philadelphia, Pa.

Combined Lathe Centers with Dogs—Planer Vise.

Editor American Machinist:

I present herewith sketches of two convenient tools for the consideration of mechanics.

The first, which is represented by the accompanying engraving, Fig. 1, is that of a lathe center, having a toothed steel collar upon it for driving small, round work, where light cuts are to be taken. The piece of work is first to be placed upon the centers; then, by tightening the nuts, shown, the teeth of the steel collar are pressed into the end of the piece to be turned, and cause it to rotate.

The jam nut is for preventing the other nut from working loose. Another form of this tool is shown in Fig. 2, where a key is used instead of nuts. The third form of this tool, shown in Fig. 3, differs from the other two, inasmuch as the taper and toothed collar are made of a solid piece of steel, while a small center is nicely fitted to a parallel hole in the main center, and has a spring for pressing it firmly against the end of the work. This is particularly adapted for wood work, as in pattern making.

The planer vise represented by the other drawing, presented herewith, is intended for holding parallel pieces of work, so as to permit the top and two sides to be planed perfectly parallel without resetting.

A represents the bed, *B* the stationary jaw, and *C* the movable jaw, which is operated by the screw *E*. The piece of work *G*, is held between the two corrugated jaws *D D*, *F F*, which are in turn secured by the set screws *H H*. For a large vise of this kind I should adopt a design in the shape of a lathe head and tail stock. N. A. NEILSON.

Chicago, Ill.

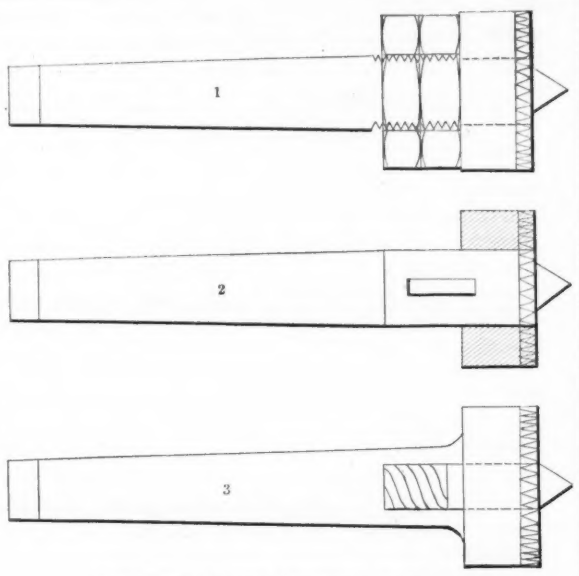
Improvement in Lathe and Planer Tool Posts.

Editor American Machinist:

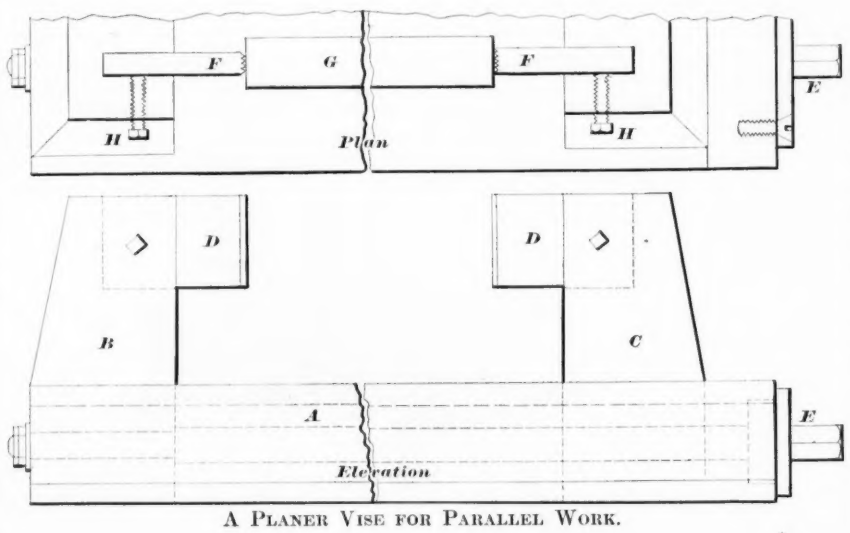
I believe that engine lathes in general, especially those used for chucking, are built entirely too light in the live spindle and forward bearing. The heavier the spindle and larger the bearing, the less liable is chucked work to chatter when operated upon. Boxes on engine lathes should not fill up snug between collars on spindle, as many lathes are built. There should be enough clearance to enable the lathes-man to know that no heavy pressure comes on the ends of boxes, but on the step at end of spindle, where all longitudinal pressure should be.

The bottom side of the hinged tool block on many recently-built planers has a bearing the whole of its length.

This often causes bad, uneven work, on account of a tool not quite straight drawing the block into conformity with itself, making the block convex on the under side, thereby raising the block off the lower and most important part of its bearing. This will readily be understood by an inspection of Fig. 1 of the accompanying engravings, where *A* represents a crooked tool which by tightening raises the points *B C*, and depresses the center, at *A*. This buckles the tool block, so that it stands open at *D*, and touches the support only at *E*.



COMBINED LATHE CENTERS WITH DOGS.



A PLANER VISE FOR PARALLEL WORK.

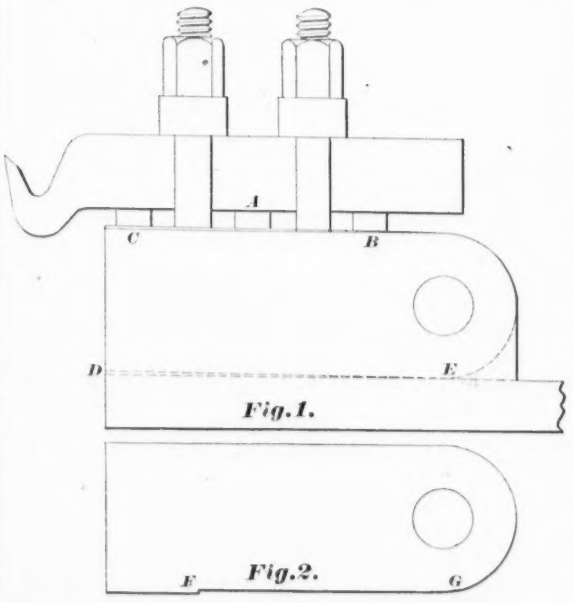
This should be remedied by allowing but one or two inches to bear at bottom end of block, by planing the remainder away about 1-16 in. deep, as shown at *F G* in Fig. 2. Never let the bearing extend above the lower set of bolts. This surely is not new to all machinists, but it is apparently new to some builders of machine tools.

Iowa City, Iowa. J. E. MCCONNELL.

Mushet Steel—Male and Female Chasers.

Editor American Machinist:

I am desirous of acknowledging the communication of S. W. Goodyear, which appeared in your issue of March 4th, in reference to Mushet steel. I had not had much experience with this peculiar metal, hence my desire to elicit information from some one well versed in the chemical compositions and physical properties and conditions of steel. I have reasons to suppose that that gentleman's theory of "excess of carbon" is the probable cause of the distinction in question, inasmuch as it agrees with the result shown by the chromatic variations of varying grades, ranging from wrought iron nearly free from carbon, and decarbonized steel, to mild steel, high cast steel and cast iron.



The results of the experiments given are interesting although I am not able either to verify or refute them. One fact in connection with my own simple experiments I may however mention. After several vain attempts, I eventually succeeded in so far annealing several discs, about $2'' \times \frac{1}{4}''$, as to be able to either drill, turn, mill or file them; in fact as soon as I am able I intend to complete them as milling cutters, when, if after they are restored to their normal condition, they have not been injured by the ordeal, and promise any interesting or valuable result, I will communicate the same.

I should not have sent this imperfect communication had it not been necessary for me to acknowledge the obligation I am under to J. G. Xander, for calling my attention to the plan I submitted for making chasers. The only explanation I can give is, that as the idea was an *impulsive expedient*, and executed at a tangent, as it were, it did not receive the consideration it should have had; and furthermore, as no complaint was made about it (I presume the inside tool was never required or I undoubtedly should have known the error), it had never occurred to me until pointed out by your correspondent, although so palpable. Permit me, however, to mitigate my chagrin a little, by telling you that about two weeks after my letter was published an old machinist called on me who "could cut screws with any one," who said he "had used that method many times, and as much as 30 years ago!"

By the by, do we call things by their right names when we designate the *outside* tool the *male* and the *inside* tool the *female* chaser—we should hardly call the *tap* the *female* or the *die* the *male*. W. DICKS.

Toronto, Canada.

Qualifications of a Good Foreman.

Editor American Machinist:

I advertised last month in your paper for a foreman, four machinists and a blacksmith, and I wish you to publish this letter in reply to the many applicants who answered the advertisement, to assure them that their applications are not forgotten, but have not yet been reached on the long list, and in this connection I wish to call your attention to a phase of the "labor question," or what might perhaps be more properly called the "no labor question."

In answer to the advertisement I received 182 applications for the foreman's situation, the applicants representing 18 States, 1 Territory, and 2 Canadian Provinces, 10 applications for jobs as journeyman machinists, and 2 from blacksmiths.

Judging from the names and styles of letters received I should rate the nationality of the writers who applied for foremanship about as follows: Americans, 154; Germans, 12; English, 10, and Irish 6; five journeymen in about same proportion.

The literary ability displayed in letters ranged all the way from good scholarly business letters down to the smutty sheet, setting forth in most diabolical chirography, the merits of the writer in a letter commencing "i am a mashenest and engener."

The question as presented above shows that there is a great amount of mechanical ability among our machinists of the higher grades, or that some men are over-rating themselves. From the figures it appears there are 18 foremen for each journeyman, and if a shop is to be organized on that basis the journeyman would be like the private in the military company which had a full complement of officers, non-commissioned officers and musicians with but one private. The latter declared when the company were ordered out for drill, he could execute the manual of arms, loading and firing, maneuvers in line and in column, but when ordered to form a hollow square it was "terribly wrenchin" on his equipments, and so the journeyman machinist would find his situation. With such a division of labor, the overworked journeyman although having the supervision of the eighteen foremen, would hardly make a business come out "square." Moral—Too many of our American boys want to be "boss," and have some one else do the work.

Among the men who have applied for the situation of foreman, are some excellent workmen who are known to be good shop overseers; also many competent workmen, and quite a large number who are not competent, none of whom are known to have any ability as overseers or foremen, and with the limited amount of information furnished by each, it is a work requiring much time and patience to select a man who would suit and be suited.

As my advertisement was addressed to young men, I will also address this letter to young men, including apprentices (to whom I may say a word at some future time), stating what qualifications I like, and am willing to *pay for* in a foreman, and shall name them in the order in which I rate their importance, viz.: Honesty in business transactions, and in doing work.—Capability to manage a shop so as to do work profitably, *i.e.* to *make money*.—Good mechanical ability, with a fair knowledge of the trade, including draughting, and an inclination to improve.—Temperate, steady habits, with the faculty of saving his own money.—Gentlemanly habits, including politeness, order, cleanliness, a cheerful disposition, and freedom from profanity, obscenity, or dissipation of any kind. The first three requisites are indispensable.

Mr. Editor there are few men possessing *all* the qualifications of a good foreman, but as the men in my shop are my associates, more than any others, I will say, the more of the above qualifications a man has, the more of my money he can get, and the longer he can stay with OLIN SCOTT.

Bennington, Vt.

[If Mr. Scott would qualify his "moral" to the effect that too many American youths want to be "bosses," before being qualified

for such positions he would be more nearly correct. The ambition to become a foreman, superintendent or proprietor of a shop is a laudable one, and we rejoice that American youths are first and foremost in such aspirations.]

Extracts from Chordal's Letters.

CONFUSED IDEAS ABOUT BABBITT METAL—WHAT BABBITT IS AND WHY IT IS USED—A SHOP WITH SERVANTS FOR THE WORKMEN — DIFFERENT COMPOSITIONS FOR JOURNAL BOXES—POURING BABBITT METAL INTO BOXES.

Mr. Editor:

* * * * It seems impossible that the world should have moved and machines have been built before the invention of babbitt metal. No boon was ever so snubbed or so abused. The diamond cutter wants something that will cut and diamond dust becomes the mainstay of his art. The machine man, in the journalistic department of his profession, seeks something which will not cut, and finds babbitt metal to be as valuable to him as diamond dust is to the diamond cutter. Ask the average machinist what babbitt is and he says that it is a composition to run into boxes. If he has a box why does he want to run anything in it? He says to get a fit without the trouble and expense of boring. What is this composition made of? Answer: Any mixed up lot of metallic stuff which will melt easily. What kind of bearings is it used on? Answer: Every kind, where to save boring would be an object. Why is it called babbitt metal? Answer, because it is used for babbitting boxes.

* * * * Such is the general machine shop view of babbitt metal. Little seems to be known of the metal itself or of its special functions. The virtues sought after seems to be brittleness, that it may be easily broken up and gotten into the ladle; fusibility, that it may be easily melted in a ladle; fluidity, that it may be easily poured out of a ladle; and cheapness withal. The whole thing boiled down means lead, with something else put into it to entitle it to the comprehensive name of babbitt metal. Regulus of antimony sounds well and will turn lead into babbitt. That is the main reason why many use antimony. Block tin is a rare metal and will work the transformation. If you call it block tin instead of tin it will make the metal more babbitty. Old type bought from the printer becomes babbitt metal when remelted, especially if a little lead is added.

* * * * Sometimes a man can be found who refers to the shrinking qualities of babbitt. He will learnedly mention that bismuth is a metal which expands in cooling, whereby it is especially fitted to completely fill the type makers' mold and make a perfect type. He will draw attention to the analogy between the printers' type and the babbitted box. It becomes apparent at once that type metal is babbitt metal, especially if a little lead is added.

* * * * Isaac Babbitt was a Boston man. He patented his metal in 1839. It consisted of nine parts of tin and one part of copper—No bismuth, no regulus (nor irregulus) of antimony, and, above all we fail to find any mention of lead. Nine parts of copper and one part of tin make a good fair brass for boxes. It is not a ladle metal, but must be cast in sand moulds and be bored, fitted, etc. It will be noticed that Mr. Babbitt turns this brass proportion end for end and gives us a metal which can be melted in a ladle, and poured around the shaft after the box is bolted in position, whereby the trouble of lining up the movable box is saved. It is, to a certain extent, an antifriction metal. It can be easily repoured at any time. It is a soft metal and will not cut a journal. It is a yielding metal and a badly set box may be squashed into shape by the pressure of the journal, and given a fairly bedded fit. Mr. Babbitt also invented the cast-iron box to receive the metal. Its well known end flanges prevented the soft metal from being squashed out at the end of the box.

* * * * There are many mistakes made about babbitt metal. A babbitted box is not, and never can be, cheaper than a bored cast iron box. In most country shops it is no small undertaking to bore a box. Not one latheman in a hundred can bore a smooth hole; and not one shop in a hundred has a reamer with which to make a rough one smooth. Not one shop in a hundred has any arrangement for boring, except a lathe and a lathe tool. In such cases a lot of babbitt and a ladle becomes a complete outfit for boring and reaming all sizes of boxes. In such shops there can be no doubt about babbitting being the cheapest way to bore a box. But it is obviously unfair to make comparison of cost where the facilities at hand are all in favor of one certain method. The figuring ought to be done when the shop has the reamers, but is just out of babbitt. With reasonable facilities for boring, a babbitt box will cost from two to three times as much as a bored box.

* * * * Cost is not the reason for babbitting boxes. The true reason is that for many purposes a babbitt box is much better than a bored box. Take the outboard box of a steam engine, for instance, let it be bored ever so nicely, where is the man who can bolt it in place and have it in line? Not being in line it, of course, bears on some corner, and some little spot has to take the bearing and stand the whole rub. Under such circumstances the enormous friction concentrated on the spot, tells in wear and cutting. The box gets cut and it cuts the shaft. There are few cases in which a bored cast-iron box would answer at all for the purposes of an engine box. The same may be said of bolted boxes for agricultural machinery and in fact almost every class of machinery in which boxes are liable to be badly set, or to get out of line by strains, or by the shrinkage of timber. The modern ball-and-socket hanger box is an excellent example of a box which will not be subject to those binding rubs which quickly ruin a rigid box of cast iron. Babbitt is no necessity in these trembling boxes. But in these same ball and socket boxes, if it is desired that they have removable caps, babbitt will be found useful. It is entirely too nice a job to fit up such boxes with caps without having some little joint edge sticking in to rub and cut. For this reason men who want split boxes choose babbitt, and those wanting cast iron boxes choose solid capless ones. Everything is in favor of the cast iron boxes, except the fact that the shaft must be stripped to get them on and off.

* * * * The Niles Tool Works had, and still has, one of those long shops running the whole length of a city block, with a tool room located in the center. Probably no better form of shop has ever been devised, but the form has one demerit. The men and the foremen and the laborers have to walk long distances in the ordinary working of things, and the long trips to the tool room are well calculated to wear the average machinist out in the leg part, even before noon. An ordinary machinist doesn't object to walking his legs off going to and from the machine shop, where he makes his living working at the trade, but he is justified in growling at a ten-mile tramp between meals.

* * * * The Niles Works have lately added three new shops to their long establishment, and the result is that the distances have increased, and the tool room is no longer in the center. It is an easier matter to build machine shops than it is to move a tool room to the spot where the center of gyration will be supposed to exist. In the shop referred to a plan has been inaugurated which, so far as I know, is new and worthy of investigation. They have put in an electric call system, with an annunciator at the tool room, and have numbered push buttons at every vise and machine, and scattered around generally. Bell boys are stationed at the tool-room bar. Tom, Dick or Harry wants a drill, or a reamer, or some waste, or his oil can filled. He touches his button and a boy dances up to him for instructions. These boys are to black their boots and keep their faces clean, and sleeves rolled down. They are not apprentices, nor cubs, nor laborers. They are the servants of the workmen. This arrangement is not yet completed, but will be in a week or two, and I will make inquiries and post you as to its workings.

* * * * If I, in my days, had been lucky enough to find myself working in a shop with a slave of the ring to answer the bell, I should certainly have insisted on the things being done up brown with a man at the grindstone to do the heavy sharpening.

* * * * At one time I dumped all the fancy tools out of my tool box, and provided myself with a tip top set of lathe tools. This was to prevent borrowing. I always hated a grindstone, and it finally occurred to me that, if I had a double set of tools, I would be happier. I doubled up and then had a pair of side tools, a pair of diamond points, three or four cutting-off tools, a patent screw-cutting tool with removable cutters, and two pairs of broad, square-ended tools. These latter were always favorites with me as I could use them for almost anything, especially for all chuck work. I never found anything so good for boring out big work, like packing rings, etc., and they could be used for all manner of big turning and facing. But the double set of tools didn't help me any on the grinding question. I got to putting off the operation of grinding till everything got dull, and then I had to go and stay by the grindstone till meal time. I always preferred a lathe to a grindstone, and my objection to having my lathe stand still an hour or two were not entirely disinterested on my part

No one ever offered to grind any tools for me, and no boy ever came around to see if I didn't want something done.

* * * * While still reminded of babbitt metal, I note the marked variations in the compositions used. A good babbitt metal is said to be composed of copper, one part; regulus of antimony, one part; and tin, ten parts. Another consists of copper, one part; regulus of antimony, one part; and tin, fifty parts. This looks as if the question of tin was not a very delicate one. Zinc is often used instead of antimony, and Babbitt's original metal had no antimony in it, nor zinc either.

* * * * Some men make up a very hard metal, which they call hardening metal. A little of this is added to melted lead as fast as babbitt is required. The merit of this plan is that you can change the character of your metal for special jobs by adding more or less of the hardening metal. Besides that, the hardening can be made up and kept in stock and lead purchased as needed.

* * * * Within the last few years babbitt metal in bars has become an article of trade. It is much used throughout the country, and many a boy has learned his trade without getting into the inner mysteries of babbitt metal. Some of this metal is first class, but some of it is sold at a price which precludes there being anything much more costly than lead in it.

* * * * Some have put upon the market patent metals under various names. Some of these metals are looked upon much as oleomargarine is in connection with butter. They say it is not babbitt at all. I consider this one of the special merits of these metals.

* * * * Users of the Morton Poole roll grinding machines have had considerable experience with babbitt metal and their substitutes. The emery wheels in these machines run very fast—somewhere up in the thousands—and require to be kept in first-class working condition all the time. These boxes are now made of block tin pure and unalloyed. They are perfectly satisfactory.

* * * * Said Fred to me, "Do you know how I pick out good babbitt when a chap comes along with samples? I knock two bars together. The one which dents the least and breaks the last is the hardest and strongest. I take that one."

* * * * The end flanges of Mr. Babbitt's boxes are bad institutions. It is the practice of some to cast these flanges just the right size for the shaft. The shaft is laid in place, luted with clay or putty, and the metal run. After a week's wear the shaft has a good rub on the flanges, and thereafter the flanges serve a three-fold purpose: they keep the babbitt from being squashed out, they ruin the shaft by cutting rings into it, and they feed their cuttings directly into the main box and thus aid in the degeneration of the whole thing. Some men look out for this and cast the flanges about an eighth of an inch large, or chip them so. The shaft is laid on leathers in the flanges and when the leathers are taken out, the job is clean and free from mud or putty, and there is a respectable distance between the shaft and the flanges. It will be some time before they touch and make trouble.

In such things as engine shafts, saw-mill arbors, shaft boxes, &c., it is an excellent plan to leave out flanges entirely, and put in just the other thing; that is put good, large rabbets in the ends of the box and let the babbitt fill them up. By the plan no harm can come so long as any babbitt is left, and at the same time, the ends are also babbitted for a collar bearing surface. This latter feature is of special importance in saw mill work.

* * * * It is hard to babbitt these rabbeted boxes. There is nothing for the shaft to rest on while being poured.

Special rigs must be made for the purpose and the only make shift I know of is to drop little pieces of wood right into the box to hold up the shaft. These wooden pieces are, of course, to be trimmed to just the thickness the babbitt is to be. Some use little blocks of babbitt instead of wood. This is the better plan, but care must be taken to avoid making the blocks of babbitt of unknown composition for fear they will be melted out when the hot metal is poured in.

* * * * The old plan of drilling a lot of short holes inside the box to keep the babbitt from coming out is still the one most followed. A cheaper way is to cut grooves lengthwise with a half round chisel. The simple fact that babbitt is to cover this clipping, often furnishes an excuse for doing it in a horribly rough manner. The looks of these roughly chipped things is what prevents the plan being continued after it is once started. Still another plan is to have a little pointing tool in the foundry by which, before closing the flask, inward projecting spurs can be provided for inside the box. It is simply a way to avoid the use of loose draw pieces to the pattern. This method is to be commended as saving the expense of drilling and the horror of seeing the chipping.

* * * * There is always a certain amount of anxiety connected with pouring a solid babbitt box, especially if it is a very long one. There are about as many receipts for keeping the thing from setting tight as there are for making the hair grow. Smoking the shaft is a plan which must always be tried and demonstrated to be a humbug. A man gets pretty hard up for amusement when he smokes a long shaft and coats it heavy enough to do any good. I once worked on a job which had two-inch shafts babbitted into tube bearings about a yard in length. There were lots of them, and I had to learn some method. I tried smoking and got sick at once. Every smoked job had to be melted out. Then I tried oil and things. Finally somebody said soap, and then the deed was done. I warmed the shafts and anointed them well with babbitt soap. Sometimes I would find a shaft turned, tapering the wrong way, and in such cases I found I could doctor the things with an extra thickness of soap so as to be able to pull the shaft out of the tubes. Such a course made a bad fit, as the babbitt did not touch the shaft just where it was needed most; but that was no concern of mine after I had exhausted my powers of pleading to get the lathe work done straight, or tapering the right way.

* * * * *

Very respectfully,

CHORDAL.

We have in type, an interesting review of the thirty-second meeting of the New England Cotton Manufacturers' Association, recently held in Boston, but the pressure of other matter has crowded it out this week as well as several letters from Practical Men.

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NEW YORK, MAY 20, 1882.

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Safety in Using Steam Boilers.

Almost every day we read of some terrible boiler explosion and consequent destruction of life. What is the remedy? Ingenious inventors have tried to answer the question by devising various forms of safety boilers. Yet an absolutely safe boiler—one that can be managed with disregard of ordinary precautions—has never been constructed, and never will be. The nearest approach to safety has been reached in forms of boilers where the water is contained in straight, bent or coiled tubes, or in small sections.

It is of course necessary to have boilers built of good materials, staunchly put together; also to have them properly set and provided with safety valves, steam and water gauges. But this is not all that is needed to protect life and property from the destructive agency of confined steam. What would be thought of the niggardliness of the owner of a powder magazine in the midst of a crowded city, who should employ a stupid ignorant man to take charge of the storing and handling of the powder, for the reason that he would work for less pay than a man who is every way trustworthy and reliable? He would be ostracised by public sentiment and probably brought to the bar of justice whether an accident should happen or not. Not so with the negligent owners of steam boilers. They are permitted to keep ignorant and incompetent men, who will work for less pay than an engineer, in charge of steam generators, thereby endangering scores of lives. When anybody proposes a law for the rigid examination of men who wish to act as engineers, to determine their capacity for such positions, an outcry is raised against interfering with private rights. But the careful boiler owners, the well-qualified engineers, and the public at large should demand both the enactment and enforcement of laws that will place greater safeguards around steam boilers. Time and again it has been shown that nearly all boiler explosions are the result of carelessness. Many of the patented appliances for boilers are good and should be used, but none of them can be relied upon to take the place of human intelligence. Let boilers be made of the most excellent materials; let them be braced, stayed and riveted in the most workmanlike manner, set upon the most approved plan, and provided with all the automatic safety valves, low water alarms, gauges and attachments that mechanical skill can devise; then place them in charge of farm laborers or cartmen, and we should, upon the ground of safety, locate our place of business at least one block distant from the nearest boiler. No system of periodical inspection, important though it be, can safely dispense with skilled and attentive engineers. The latter will make frequent examination of their boilers, and keep themselves informed as to their condition. If repairs or alterations are needed, they will insist upon having them made, and proprietors would find it conducive to their own interests to act upon the advice of careful, competent engineers.

Built-Up Work.

We publish elsewhere the discussion on the paper, "Built-up Work in Engine Construction," read by Horace See before the American Society of Mechanical Engineers at the Philadelphia meeting, and which, with the illustrations, appeared in our issue of May 13. It may be said with reference to this paper and the discussion that followed its reading, that the time was so limited, it being late in the evening on the last day of the session, it did not receive the consideration it doubtless would have otherwise received from the members. Mr. See's expressed idea in presenting the paper was rather to bring the subject up for discussion than to elaborate it.

We believe the subject in its general bearing on machine construction is deserving of more attention than it receives. While there is room for argument in favor of solid construction in some instances, in others it undoubtedly holds its place through a prejudice in favor of the fewest possible parts, instead of through any substantial reasoning. Unquestionably, the principle of built-up construction may be carried to extremes in its application, but there is perhaps less danger of this than there is in going to extremes in the direction of solid work in heavy forgings and castings, where their production entails unnecessary expense and trouble, and a loss in time that is frequently serious.

The writer, while never having had experience with built-up cranks as large as those used in ocean steamships, has been familiar with the work of building up cranks with shafts from four to twelve inches in diameter, and always found them superior in nearly every respect to solid cranks, never in a single instance in an experience of twelve years having had a single failure, but having repeatedly substituted built-up for solid-forged cranks of the same dimensions where the solid ones would not last more than a year or two. In these instances the built-up cranks were not made because they were cheaper than the solid ones, but, generally speaking, they were made in spite of the fact that they cost more, and simply because they were better.

Probably there is no reasonable doubt but that a parted or built-up crank, if properly constructed, is materially stronger than a solid one, and whether it costs more or less to make it will in the instance of large construction be extensively used; but there is no apparent reason why this principle of construction should not be greatly extended, especially where it can be demonstrated, as we believe it can in other instances than the crank, that the built-up work is the strongest, and, all things considered, the cheapest. Neither is it evident that the adoption of the principle should be limited to steam-engine construction, but, as previously intimated, it deserves looking into more than has been done with a view to its utility in all machine construction into which heavy masses of metal enter.

Grounds for Hope.

In a recent issue of the London *Ironmonger* is an article on the American tariff, in which the following paragraph occurs:

"The most we can hope for at present is a revision of the tariff which may reduce some of the duties now obtaining, and more clearly define the law as regards certain articles as to which there are almost incessant disputes between importers and the American customs officials. Already there is a strong party in favor of revision, seeing that the revenue of the country is something like $170,000,000 per annum in excess of its expenditure. At the same time, it does not follow as a matter of course that such revision would largely favor British manufactures—indeed, there are good grounds for assuming that every effort would be made to prevent the attainment of that consummation."

It may be true that Uncle Sam is very rich as compared with some of his neighbors, but so long as he is in debt nineteen hundred million dollars, and is paying interest on the greater part of it, he will not be much at a loss to place a hundred and seventy millions a year remaining after paying family expenses. His perversity in disappointing the hopes of John Bull by maintaining a protective tariff, and thereby building up so many home manufactures to rival his transatlantic neighbor, has been regarded by the latter (with many expostulations) more in sorrow than in anger.

Now he has to face the unpleasant fact that, although a revision is likely to be made, it is by no means certain that it will "largely favor British manufactures." On the contrary, with a still further exhibition of the old perversity, "the attainment of that consummation" is likely to be deferred. Still, there is hope. There are not a few individuals on this side of the water who are anxiously working for its attainment, and who regard with anything but friendly feelings a tariff that interferes, in the interest of *other* manufactures, with the desired consummation.

The New York State Legislature has a Canal Committee which is inclined to favor locomotive towage of canal boats. In arguing for the adoption of the plan before the Committee, a letter was read from the Superintendent of Public Works in France, saying that locomotive towage of boats is now in use on all the French canals, and has proved a complete success, increasing the speed of towage more than three-fold and reducing the cost more than one half.

It is believed that permission will be given to try the experiment on ten miles of canal, the passage of a bill authorizing it. There is no known reason why it should not prove as successful in this country as in France.

At the Hartford meeting of the American Society of Mechanical Engineers one year ago, Charles E. Emery presented a memorandum of the results of some experiments made by him to determine the relative value of several non-conducting coverings for steam pipes. It was stenographically reported in full for us, and published in the American Machinist two weeks after the meeting, together with a valuable discussion thereupon.

The figures representing relative value of non-conductors (Hair felt taken as 1, mineral wool showing 83 2-100 per cent., asbestos 36 3-10 per cent., &c., down to air space), were copied by technical papers in this country, and after some months found their way into foreign journals. Now, these data have reappeared on this side of the Atlantic in the columns of some of our contemporaries as results of experiments "recently" made. They will well bear re-perusal. Keep the ball rolling.

Apropos of the smoke-prevention problem, or smoke cure, as it may be called by advocates of the one system or the other, one of the correspondents of the American Machinist had an experience exactly contrary to that of the friend on whose behalf Mr. Sinton paralyzed his forefinger (see Chordal). Being in London recently, and anxious to attend the Smoke-Abatement Exhibition, he had some difficulty in finding the place where the exhibition of smoke-consuming devices was going on, few persons in that part of London seeming to know much about it. Finally, seeing a large building where many chimneys were pouring forth thick smoke, he inquired there regarding the whereabouts of the exhibition and found to his amusement that *that* was the place!

There is a growing popular sentiment averse to the awarding of medals and other tokens for alleged superiority at industrial exhibitions. The results of such awards are now very seldom accepted, as conclusive evidence of the superiority of the articles upon the merits of which they are ostensibly conferred. As the public becomes better acquainted with the methods pursued in granting awards at fairs, and the influences that often govern their bestowal, its admiration for these trophies of gold, silver and bronze, which bear the stamp of some exhibition corporation, grows steadily smaller as each succeeding crop is shaken off with the autumn leaves. Managers and judges were erstwhile supposed to be free from the little weaknesses which are known to be inseparable from those composing the great body of mankind, and who are depended upon to purchase the products of art and industry, therefore their *ipse dixit* was (formerly) looked upon with a feeling akin to reverence.

But alas! greater familiarity has emphasized the fact that they are but human after all. Instances of something like the employment of strategy by individuals in authority have occurred at exhibitions, the object being to gratify some exhibitor, whose goods had not elicited the warmest commendations of the examiners. When the latter have recommended an award of an inferior class, and have given explicit reasons for their action, managers having the governing power have conferred an award of the superior class, but—strange omission—utterly forgot to record their reasons for reversing the judges' decision. It is even whispered that in some cases, not very remote, the judges' reports have been "touched up" like a photographic print, to give them more "tone" before ex-

posing to the gaze of the common crowd. The toning process was doubtless presumed upon to make them accord with the beauties of the medal decided upon by the managers.

When exhibition medals shall have been rendered obsolete by public proscription, a considerable quantity of ill feeling between manufacturers may be expected to disappear.

On our first page this week we present a novelty in the shape of a design for a steam tricycle. It may be suggestive of ideas to some mechanics, but as a business venture we should not advise anybody to commence the manufacture of this class of vehicles. The engraving is made by the wax process by Russell & Struthers, of this city, from a photograph of the drawing upon a wax surface. This is the process by which maps are usually made.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(166) F. B. H., Auburn, N.Y., asks: Will you please tell me if there is a difference between the English and American wire gauges? *A.* Yes.

(167) J. E. B., Clinton, Mass., writes: A number of my shopmates had an argument, some claiming that the rim of a pulley moved faster than the hub. I think not; which is right? *A.* It depends upon what you mean by faster. It is evident that any point in the rim of a pulley moves more feet in a given time than a point in the hub; at the same time it is just as evident that it does not make any more revolutions in a given time.

(168) F. B., St. Louis, Mo., asks: 1. Do the wings of a fan blower fill up all the inside of the case? *A.* No. Fans are made in a variety of ways. Frequently the wings or blades are encased by means of side flanges. The blades as stated do not fill the case, a space being left all around the outside, and the blades are sometimes set eccentrically with the inside of the case. 2. Are the blades put in a straight line (radially) from the center? *A.* Usually, we believe, they are.

(169) F.W.S., Auburn, N.Y., asks: How shall I work out the horse power of a steam engine 4″ x 6″ at 240 revolutions; boiler pressure, 70 pounds, cut off at half stroke? *A.* Find the area of piston by squaring the diameter and multiplying the product by .7854, thus $4\times4\times.7854=12.56''$, which is the area of the piston. To get the *net* area of piston you should deduct one-half the area of the piston rod, say drop the fraction and call the net area of piston 12″. With a boiler pressure of 70 pounds and a cut-off at half stroke, you may probably get a mean effective pressure of 40 pounds. The piston travel is 240 feet per minute. To find the horse power, multiply together net area of piston, the mean effective pressure and the piston speed in feet per minute, and divide the product by 33,000, thus: $\frac{12\times40\times240}{33{,}000}=3.4$ horse power.

(170) J. R., Detroit, Mich., writes: 1. I am a fireman and want to become an engineer. Is it necessary to be a machinist before I can be an engineer? *A.* No. The majority of engineers are not machinists. You should, however, learn all you can about taking apart and putting together a steam engine, and learn to use a file, hammer and chisel and such tools. 2. One morning recently as I was about to fire up I observed an unusual commotion in the water glass, the water flying from the top to the bottom of the glass. On opening the valve at the bottom of the glass no water appeared, but instead, on putting my finger under the valve I found that air was rushing in. I then opened the gauge cocks with the same results. I dare not fire up as there appeared to be low water, and while thinking what to do, suddenly the water ran out of the cocks and everything was all right. Can you tell me what was the cause of this? *A.* The cause is very simple and the occurrence common. When you stopped the night before the steam room in the boiler was filled with steam. As the boiler cooled down this steam was condensed and as air could not get in to take its place there was a partial vacuum in the boiler, that is, the pressure of the atmosphere outside was greater than the pressure inside the boiler, so that when you opened the cocks the air rushed in as you described. In firing up in the morning, if there is no pressure on the boiler, raise the safety valve and let it remain open till the boiler begins to make steam. If it is not practicable to open the safety valve, open any cock in the boiler that is above the water level and that leads to the atmosphere. The upper gauge cock will do better than none. 3. Will you tell me in a compound engine how it is possible to exhaust from one cylinder to another more than it would be possible to exhaust from one boiler to another? *A.* As the piston of the low pressure cylinder moves along the pressure is constantly growing less by expansion, so that the steam follows it. The forward pressure on the low pressure cylinder cannot be *more* than the back pressure on the high pressure cylinder. 4. What must the relative positions of the two pistons of the high and low pressure cylinders be, and what the cut-off? *A.* Sometimes the pistons move together, sometimes in opposite directions, sometimes at right angles to each other and sometimes they have still other relative movement. Sometimes there is a cut-off on the high pressure cylinder, and sometimes on both cylinders. 5. How is a vacuum weighed or measured by pounds on the gauge or glass. I have tried to study this up but can't understand it. How is a column of mercury supported by a vacuum? *A.* Vacuum, strictly speaking, means the absense of everything. It is customary to speak of it, however, as denoting the *degree* in which something is absent, as notably the pressure of the atmosphere. The pressure of the atmosphere varies slightly at different times, and considerably in different localities, but may be assumed to be 14.7 pounds per square inch, at which pressure it will balance a column of mercury 30″ high. If you consider the pressure in any vessel partly removed, as by the operation of the air pump, then the vacuum gauge (which may be a mercury column or a spring gauge) will show to what extent it is removed. The mercury is not supported by a vacuum, but by the pressure of the atmosphere, and the height at which it is supported represents the difference between the pressure of the atmosphere and the pressure in the vessel with which the gauge is connected. Put one side the somewhat senseless use of the word vacuum, and consider all pressures as measured from a vacuum, which is nothing, and the whole matter will be simplified. 6. What is meant by cut-off at .89, or .45, or .682 of the stroke. *A.* It means that when the piston had traveled 89-100, 45-100, or 682-1000 of the stroke the steam is cut off by the operation of the valve. For instance if the stroke of the engine is 20″ and the cut-off is at .45 of the stroke, then $20''\times.45=9''$; that is, after the piston has traveled 9″ no more steam is allowed to enter the cylinder.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

We receive numerous inquiries relating specially to matters of private interest. While desirous to oblige our friends, we would suggest, that an advertisement of two or three lines under this heading will usually develop the desired information easily and quickly.

Portable Forges, $10. Holt M'fg Co., Cleveland, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

James W. See, Consulting Engineer, Hamilton, O.

Presses and Dies. Ayar Mach. Works, Salem, N. J.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

J. C. Hoadley, Engineer and Expert, 29 High St., cor. Federal, Boston, Mass.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Do you manufacture Hardware or House furnishing goods you wish sold in New York? If so, address Manufacturer's Agent, care of AM. MACHINIST.

The undersigned would be glad to obtain the address of a maker of augers for boring Pump Logs. J. C. Hoadley, 29 High street, Boston, Mass.

Machinists' Bench Tools; largest stock in the United States. Send for Machinist Catalogue, 212 pages. Tallman & McFadden, 607 Market st., Philadelphia.

Jas. F. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users and engineers. [Mention this paper.]

"Slide Valve Gears," by Hugo Bilgram, published by E. Claxton & Co., Phila., describes the easiest method known for correctly proportioning slide valves, link-motions and cut-off gears; price, $1.00.

Cumberland-Blossburgh Coal; the best blacksmith coal in the United States. Free from sulphur and earthy matter. Never clinks; forms a perfect weld. Shipped to all points west by C. C. & E. M. Johnson, Room 21, Coal Exchange, Pittsburgh, Pa.

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

Frederic Egner, Engineer, Norfolk, (Va.) City Gas Light Company, writes to T. New, 32 John Street, New York: We do not need any Prepared Roofing this spring. If we did would certainly get yours, as it has thus far given complete satisfaction, and is in every way equal to your representation.

Steam Economy, by A. Wilkinson, M. E., No. 123 N. 4th street, Philadelphia, Pa. A new work on steam. Illustrated with numerous diagrams taken from engines in this country and in England. Points out and remedies defects in steam engines. Great variety of practical information for steam users. 124 pp., in cloth, $1.00 by mail.

If you desire to keep pace with the daily progress and development of Telephone, Telegraph and Electrical matters, have a copy of the NEW YORK REVIEW OF THE TELEGRAPH AND TELEPHONE sent to your address. Only $2.00 per annum. George Worthington, Editor and Proprietor, No. 23 Park Row, New York. P. O. Box 3329.

Bound Volumes and Patent Binders. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, or Volume 4, containing the 53 issues of 1881, neatly bound in cloth, ready to ship by express, for four dollars. Either volume unbound, three dollars. "Patent Binder" for the AMERICAN MACHINIST holds 53 weekly issues in good shape. Sent to any address by mail for one dollar. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

Ealy's "Blue Book,"—Special classified list of Machinists, Machinery, Railway, Engine and Boiler Makers supplies, etc., with financial standing and paying qualities of all dealers and manufacturers. Much more convenient and reliable than any other work of the kind published. We also furnish full detailed written reports. Trial rate to July 1, 1882. The JOHN W. EALY COMPANY, 51 Chambers street, New York or 79 Dearborn street, Chicago, Ill.

To Mill Owners--Hodgson's Patent Saw Grinder is simple, efficient, and very cheap. Made in Weisport, Pa., and Amherst, N. S. Agents wanted. Circulars free. Say where you saw this. T. Hodgson, Amherst, N. S.

"Extracts from Chordal's Letters," the most interesting mechanical book published. A great variety of mechanical and business topics treated in a wise and witty way that will be instructive to old and young mechanics, and interesting to everybody. As many as 150 copies have been sold in a single shop. Over 40 Humorous illustrations; 320 pages, 12 mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.

MANUFACTURES.

The Excelsior Brewing Company, of St. Louis, Mo., are setting a boiler with the Jarvis Furnace, to burn wet hops and slack coal.

A new machine shop is building at Waterbury, Conn., by the Farrel Foundry and Machine Company.

The capacity of the Lincoln Iron Works at Rutland, Vt., will probably be greatly increased by the erection of new buildings.

The Taylor Manufacturing Co., of Chambersburg, Pa., which proposes to build locomotives, has been chartered, capital stock, $150,000.

The Birmingham Foundry and Machine Co., Birmingham, Conn., are very busy, and complain of the scarcity of good machinists.

Carrington & Co., brass goods manufacturers, Waterbury, are very busy, and complain of the scarcity of skilled brass workers.

The Carter Foundry Co., Ansonia, Conn., have added a new steam engine, a boiler and other tools. They make a specialty of fine brass castings.

F. C. & A. E. Rowland, New Haven, Conn., are busy making lathes and other machine tools for the new Rome, N. Y., Locomotive Works, besides building engines and other work.

Mast, Foos & Co., Springfield, O., are about to build a 100 foot extension to their foundry. They are now melting 8 to 10 tons a day, and this addition will more than double their capacity.

Reece Brothers, who have been manufacturing taps and dies at the shops of the Greenfield, Mass., Tool Company, have just bought a large lot and will build a shop for their own use.

Hall & Brown are building a two-story 48x87-foot brick addition to their works at St. Louis, Mo., to be occupied by them for the manufacture of wood-working machinery.

Louisville is the largest producer of plows of any city in the world. There are seven factories with a capital of $1,130,100. Over 100,000 plows were made in 1881.

It is the intention to start the Exposition Cotton Mills at Atlanta with 10,000 spindles, to be increased to 20,000, and with looms sufficient to weave the yarn from all the spindles employed.

Robert Jamison is building a new machine shop two stories high, which will be fitted up partly with new machinery. His specialty is paper mill and flouring mill work.

The shops of the Long Island Railroad Company are to be removed from Hunter's Point to Jamaica, N. Y. The location of the shops in Jamaica will be the means of distributing $4,000 a month among tradespeople.

The city authorities of Marshalltown, Iowa, exempt, from municipal tax, all manufacturing establishments for five years, and supply from the city water works all water needed at cost of pumping.

Parker Bros., of Meriden, Conn., have gone into the manufacture of machinists' tools, and are already turning out well-constructed small planers. They resemble those made by the Pratt & Whitney Co., of Hartford.

The Montgomery Iron Works, Montgomery, Ala., which have just started for locomotive repairing and the manufacture of agricultural machinery, are already full of orders for locomotive work sufficient to keep the shop in operation for six months.

The Hewes & Phillips Iron Works, Newark, N. J., are full of orders for machine tools. They are getting out new patterns for a 24″ planing machine and a 12″ shaping machine. About 300 hands are employed.

E. C. Stearns & Co., manufacturers of wagon makers' tools at Syracuse, N.Y., are adding a building 60x100 feet, three stories high, to their factory. They expect to occupy the new building by June next. About 100 hands are employed.—*Manufacturer's Gazette.*

Since the withdrawal of Mr. Whipple from the Parker & Whipple Co., of Meriden, Conn., he has organized at Cleveland, O., a stock company to manufacture locks and other small wares. The old concern has been preparing to turn out the clock known as the "Little Jewel."

The Hartford Engineering Co. have just received a very large planer from the Farrel Foundry and Machine Co., Ansonia, Conn. It occupied two platform cars in transmission. The latter concern is very busy in making Cornish rolls, ore and stone crushers, large machine tools, etc.

A smokeless and sparkless locomotive was tested recently on the Fitchburg railroad. The run was to Waltham and back, a distance of twenty miles, with a consumption of 273 pounds of Cumberland coal for the round trip. The average consumption of coal for a twenty-mile trip with an ordinary engine is about 1,000 pounds.—*Railway Register.*

It is stated that a large foundry and machine company is being organized in Ansonia, Conn., for the manufacture of pulleys, shafting and large machinery. The concern will have at its head some of the most skilled mechanics and engineers in the place, and will be backed by the wealthy manufacturing interests.

The Western Foundry and Machine Works are placing in their new establishment, cor. 23d street and Stewart avenue, about $5,000 worth of the latest improved machinery. The main shop is 125x60 feet and the entire works cover 161½x125 feet. They will make a specialty of grain elevators and all kinds of architectual and machine work. —*Chicago Industrial World.*

Representatives of the Suspension Car-truck Manufacturing Company are in Chicago, looking for a site upon which to erect shops for the construction of suspension car wheels. The establishment will have a capital of $300,000. Among the directors of the company are W. H. Barnum, and other capitalists of natoinal reputation.

The pay roll at the Albany & Rensselaer Iron & Steel Co., amounts to $50,000 monthly. Allowing for stoppages and repairs, the amount paid out at these mills is about $500,000 a year. Owing to the increased capacity the pay roll this year will be somewhat larger. If the tariff were taken off this money would go to workmen in England, Germany and Belgium, instead to those of Troy, N. Y.

Ex-United States Senator A. McDonald, Hugh J. Jewett, of the Erie Road; A. S. Sullivan, of New York, and Milton Taylor, of Cincinnati, have organized the Florida Mill Land and Lumber Company, with a capital of $500,000. They have purchased 625,000 acres in three of the Gulf counties of Florida from which they propose to take yellow pine for shipment to New York. Their principal office will probably be in Newark, N. J.

The buildings formerly owned by the Empire Sewing Machine Company in the town of Somers, Westchester County, N. Y., have been purchased by the Manhattan Roman Catholic College of New York city. The factory will be remodeled and a mansard roof added. It will be used as an Industrial school, where many kinds of goods will be manufactured, and a Catholic printing and publishing house established. The property purchased includes 136 acres of land, eight large double brick houses, a large hotel, a valuable water power, the brick factory and a farmhouse. Only $12,750 was paid for the entire property.

The Atchison, Topeka and Santa Fe shops at Topeka, have just turned out a complete passenger train, every article of which, including locomotive, tender, baggage, postal cars and passenger coaches, from the heaviest work to the most elaborate finish, including the very lanterns used by the train hands and excepting only the paper wheels of the baggage cars, was manufactured entirely at Topeka. It has 18x28 inch cylinders and 60 inch drivers, and cost $8,500, against $13,000 charged by eastern makers. The baggage cars, of which 24 were built, cost $3,574 each; the 9 postal cars cost $3,741 each, and the passenger coaches $6,300 each—*Albuquerque Herald.*

Crocker & Pell, Founders, Machinists and Engineers, Minneapolis, Minn., write us that though the season is said to be rather quiet, they are pushed with work, running nights to keep up with orders and from the fact that they have been delayed in getting their orders for heavy tools filled, have been obliged to get considerable work done outside. They have recently added to their tools, a heavy shaper, a No. 3 Brainard milling machine, three engines and two pulley lathes, and a key-set cutter. They are putting up a crane for heavy work, and a large core oven in foundry, and lathes, planers, saws, etc., in their wood-working department. They are building a flour mill, portable saw mills, an electrical machine, and are doing general jobbing and getting patterns ready for building steam engines. They write us that building business is lively, the Chicago, Milwaukee & St. Paul Railroad shops being well under way, and the Minneapolis & St. Louis Railroad shops, about completed.

We noted some weeks since the fact that the Niles Tool Works of Hamilton, Ohio, had opened a branch house in Philadelphia. They have since issued the following circular: "In order to facilitate our trade with this market, we have arranged to open a branch office and warerooms in the new Ellison Building, No. 22 South Sixth street, under the management of Mr. E. V. Douglas, late with Kelly & Ludwig, of Philadelphia. Every opportunity will here be provided to acquaint the purchaser with all the details of our machinery, and we propose to keep on hand at this point, as large a stock as the condition of trade will admit of. In addition to our own tools, our stock will comprise the product of several other well-known firms, for whom we will act as agents, namely: Messrs. Morgan, Williams & Co., builders of Steam Hammers; The Long & Alstatter Co., builders of Heavy Punching and Shearing Machinery; Messrs. Grant & Bogert, builders of Small Lathes, and other Machine Tools of very superior quality; also a number of other makers of first-class tools."

Machinists' and Engineers' Supplies.

NEW YORK, May 4, 1882.

The supply market remains in about the same condition as last week. Orders continue to come in slowly and of small proportions. Manufacturers are busy on unfinished orders.

Iron and Metal Review.

There has been no noteworthy change in the condition of the Pig Iron Market since our last report. The demand and suply seem to be pretty evenly balanced and prices are firm. Orders are small and consumers do not seem disposed to purchase more than is required for immediate use.

We quote prices as follows: Foundry No. 1, $25 to $25 50; Foundry No. 2 X, $24 to 24.50; Grey Forge, $22 to $22.50; Foreign Iron is weak and may as a rule be purchased at a concession from quotations. Sales are made with difficulty. We quote: Gartsherrie, at $25 to $25.50; Coltness, $25 to $25.50; Glengarnock, $24 to 24.50; Carnbroe, $23 to $23.50; Englinton, $22,50 to $23; Summerlee, $25: Steel and Iron Rails are fairly active, at $50 to $52. Wrought Iron Scrap is in fair demand at $30 to $30.50 prime from yard. Prices for other metals substantially as quoted last week.

WANTED

"Situation and Help" Advertisements, 30 cents a line, each insertion. About seven words make a line. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—A situation by a Mechanical Draughtsman. Address A-N, Box 4, AMERICAN MACHINIST.

Wanted—A first-class planer hand on watchmakers tools. Address, Moseley & Co., Elgin, Ills.

Wanted—Five good moulders and five good core makers. Address, Holyoke Machine Co., Holyoke, Mass.

A thorough pattern and model maker wants employment West or South. W. Edwards, 151 Almond street, Syracuse, N. Y.

Wanted—By a young man a position as foreman and draughtsman, now occupying a similar position Address Comadore, care AMERICAN MACHINIST.

Wanted—Practical Machinist with some capital and good references, to take interest in established paying business near Pittsburgh, Pa. Address, box 1, AMERICAN MACHINIST office.

Wanted—A first-class machinist to take permanent charge of Tools and Appliances. Fred'k B. Miles, Machine Tool Works, 24th and Wood streets, Philadelphia.

The Ottawa Iron Works, Ferrysburg and Grand Haven, Michigan, want a few good machinists. Steady work and best wages. Reliable married men will find this a good opening.

Machinist and Draughtsman, 9 years experience, desires a situation. Locomotive work preferred. Address, Draughtsman, Box 2, care AMERICAN MACHINIST.

Wanted—A good boiler maker to do general work on new boilers and repair old boilers. A steady job to a good, steady man. Address, stating age, kind of work can do, and wages, Geo. R. Lombard & Co., Augusta, Ga.

Wanted.—An experienced Traveling Man in the Injector business. One who thoroughly understands the trade, both practically and as a salesman. Give references and salary expected. Address, A. B., care AMERICAN MACHINIST

A man 31 years of age desires a situation in a machine shop as superintendent or foreman. 13 years' experience as apprentice, journeyman, toolmaker, draughtsman and foreman in Illinois, Iowa, Minnesota, Nebraska, Kansas and Missouri. Correspondence invited from parties who mean business. J. E. McConnell, Iowa City, Iowa

For Sale—One first-class Iron Planer 16 feet long, 60 inches wide; extra heavy, reliable tool. S. L. Holt & Co., 67 Sudbury street, Boston, Mass

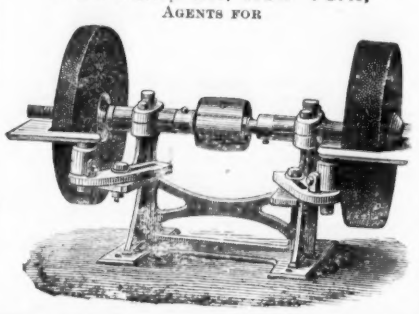
Cheap Lathes—I have a pair of 36-inch lathes which I can deliver in a few weeks, with length of beds to suit buyer, at a very low figure E. H., Box 6, AMERICAN MACHINIST.

COOKE & CO.

(Formerly Wm. Cooke, successor to Cooke & Beggs')

6 Cortlandt St., New York,

AGENTS FOR



The Lehigh Valley Emery Wheels and Emery Wheel Machinery.

Our wheels possess superior cutting qualities, combined with great durability. Eureka Plow Polisher and Patent Stove Plate Grinders.

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MANUFACTURER OF

Machinery and Tools,

IMPROVED WIRE FEED SCREW MACHINES, GUN AND SEWING MACHINE TOOLS, DIES FOR DRAWING, FORGING, BLANKING, &c., MADE TO ORDER.

Manufacturer of

THE SECOR SEWING MACHINE,

Factory Cor. Broad & Railroad Ave.

BRIDGEPORT, CONN.

SHEPARD'S CELEBRATED $60 Screw Cutting Foot Lathe.

Foot and Power Lathes, Drill Presses, Scrolls, Saw Attachments, Chucks, Mandrels, Twist Drills Dogs, Calipers, "Sun Light" Gas Machines, etc. Send for catalogue of outfits for amateurs or artisans. Address

H. L. SHEPARD & CO.,

341 & 343 WEST FRONT STREET, CINCINNATI, OHIO.

ROSE'S PATTERN MAKER.

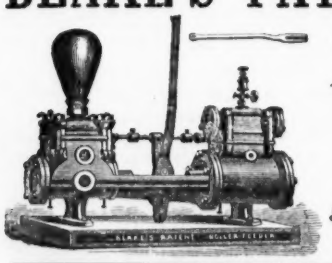
The Pattern Makers' Assistant, embracing Lathe work, Branch Work, Core Work, Sweep Work, and Practical Gear Constructions, the Preparation and Use of Tools, together with a large collection of useful and valuable Tables. By JOSHUA ROSE, M. E. Illustrated with 250 Engravings. 8 vo. Cloth. 350 pages. $2 50.

D. VAN NOSTRAND,

23 Murray and 27 Warren Sts., N. Y.

Copies sent by mail, post paid, on receipt of price.

BLAKE'S PATENT STEAM PUMPS.



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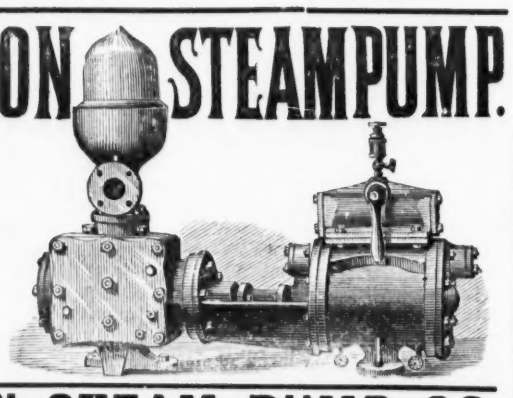
THE CAMERON STEAMPUMP.

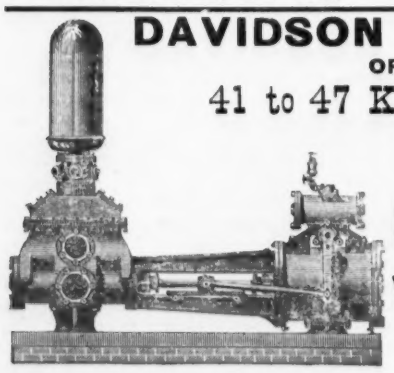
Is the Standard of Excellence

AT HOME AND ABROAD.

THE A. S. CAMERON STEAM PUMP WORKS,

Foot of East 23d Street, New York.





DAVIDSON STEAM PUMP CO.

OFFICE AND WORKS:

41 to 47 Keap Street, Brooklyn, N. Y.

MANUFACTURERS OF

THE M. T. DAVIDSON Improved Steam Pump.

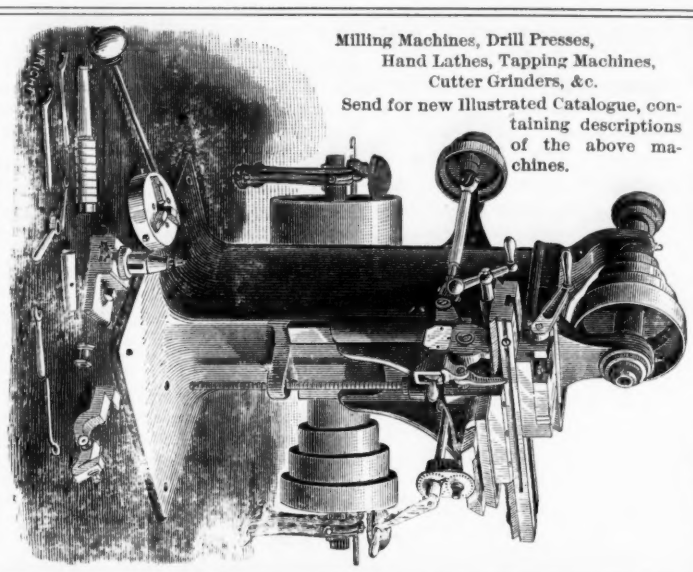
Warranted the Best Pump Made for all Situations.

KELLY & LUDWIG, Agents, 49 and 51 North 7th St., Phila., 97 Liberty St. New York.

E. E. CARVIN & CO.

MANUFACTURERS OF

Machinists' Tools.



Milling Machines, Drill Presses, Hand Lathes, Tapping Machines, Cutter Grinders, &c.

Send for new Illustrated Catalogue, containing descriptions of the above machines.

No. 2 Power Milling Machine. Price, as shown in cut, $400.00.

Office and Works, 139-143 Centre St., New York.

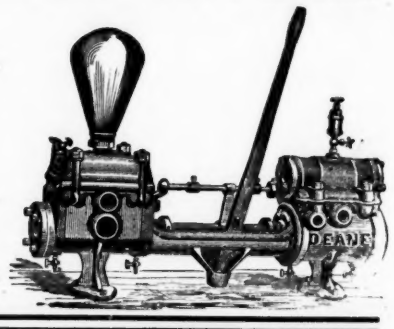
"THE DEANE" STEAM PUMPS FOR EVERY SERVICE.

Send for New Illustrated Catalogue.

The Deane Steam Pump Co.

HOLYOKE, MASS.

92 & 94 Liberty St., New York. 54 Oliver St. Boston. 226 & 228 Lake St., Chicago.



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W. H. STEWART, *Secretary.*

D. H. TUTTLE 21 BEEKMAN ST NEW YORK Engraver on Wood MECHANICAL WORK A SPECIALTY

"THE NATIONAL CHUCK"

WARRANTED SUPERIOR TO ANY CHUCK IN THE MARKET

NATIONAL M'F'G CO. NEW HAVEN, CONN

REMOVAL,

New York, May 1st, 1882.

E. & F. N. SPON, Publishers and Importers of Scientific Books, beg to notify their customers and and friends, that they have removed to 44 Murray street, one block from City Hall.

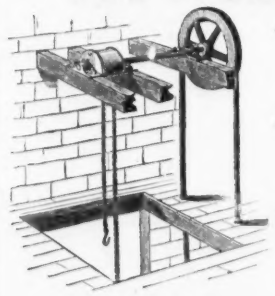
BRADLEY'S CUSHIONED HAMMER

BRADLEY & COMPANY SYRACUSE, N Y

"Double Lift" Hoists,

WESTON'S PATENT.

FOR STORES, FACTORIES, MILLS, &c.



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As one hook ascends the other descends, and is thus ready for the next load.

LOAD ALWAYS SELF-SUSTAINED.

CANNOT "RUN DOWN."

ACCIDENTS IMPOSSIBLE.

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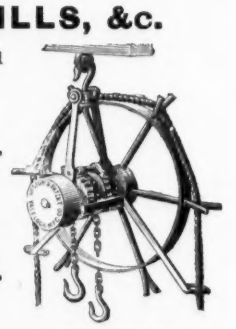

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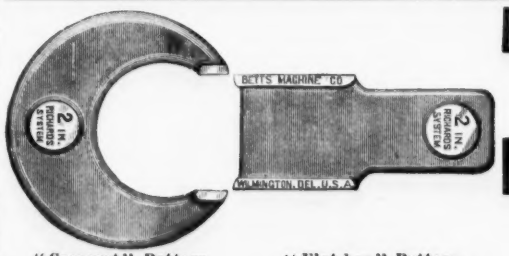

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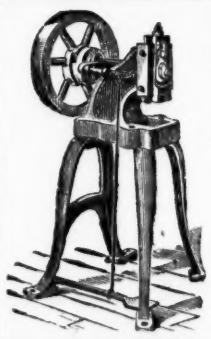

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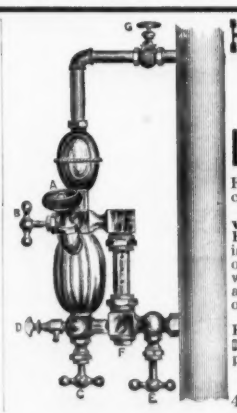

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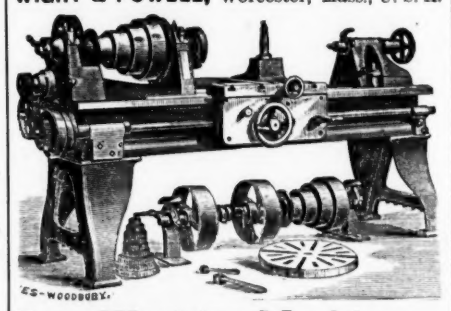

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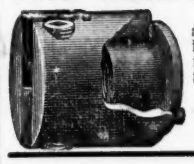

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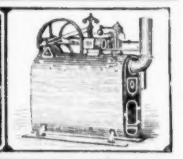

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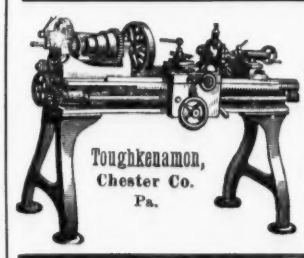

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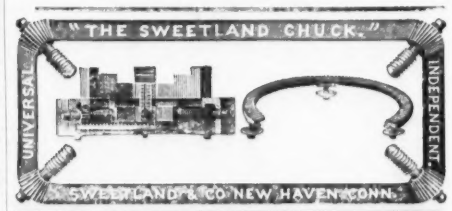

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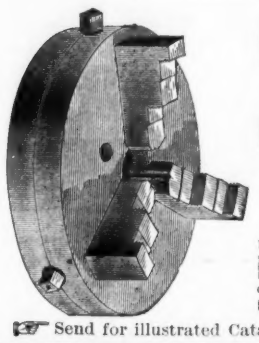

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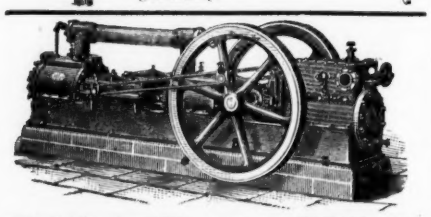

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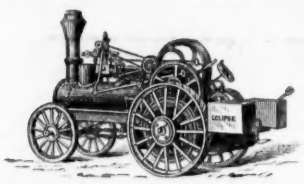

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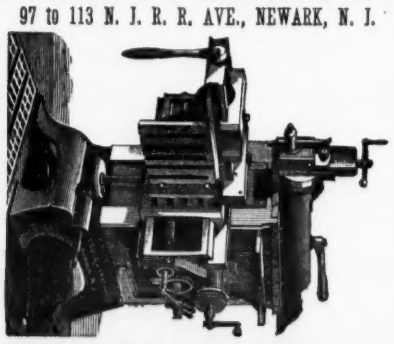

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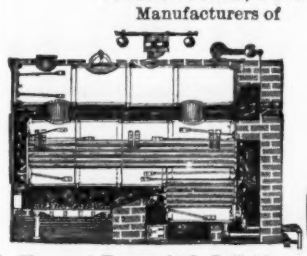

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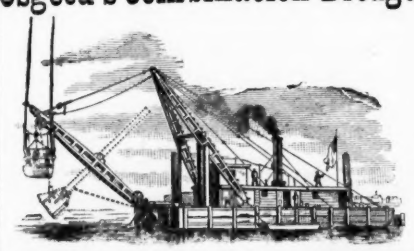

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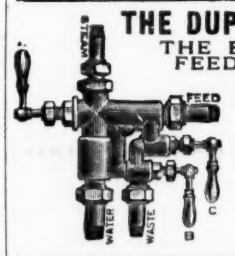

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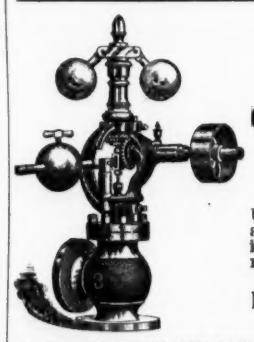

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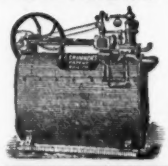

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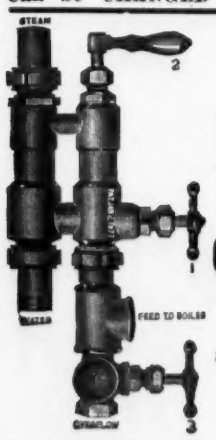

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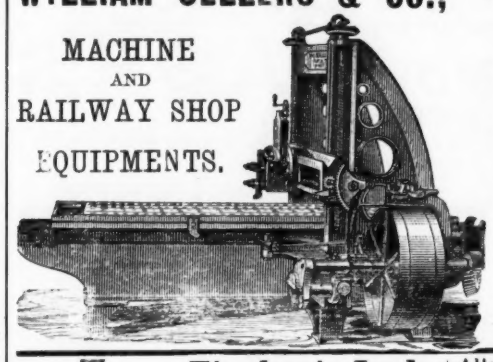

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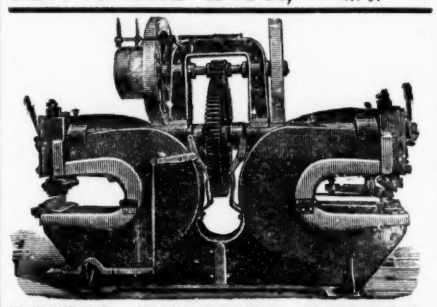

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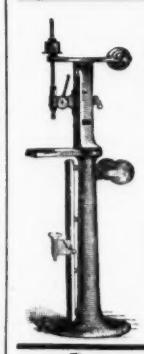

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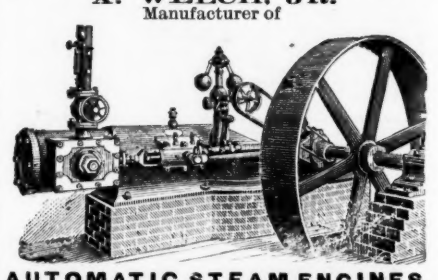

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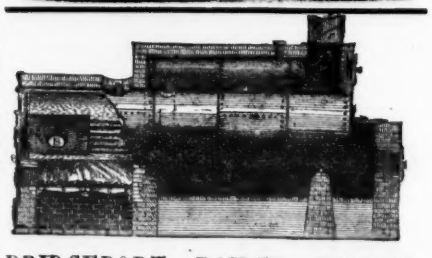

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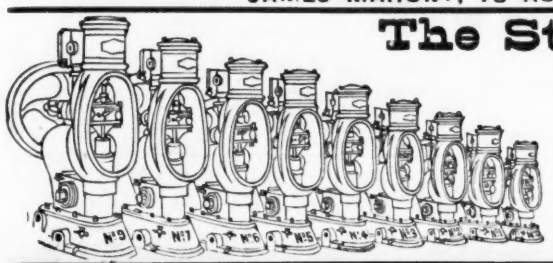

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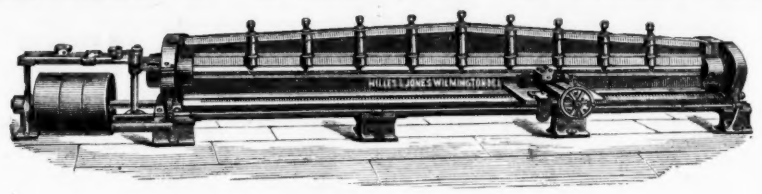

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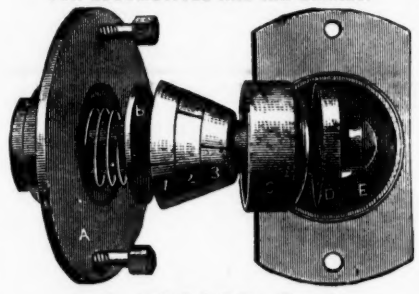

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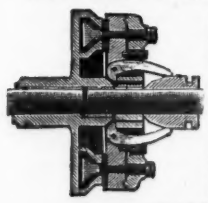

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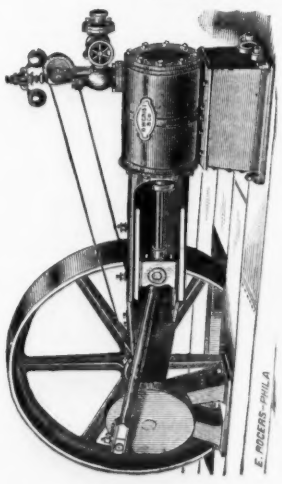

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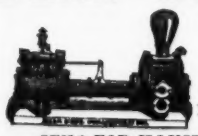

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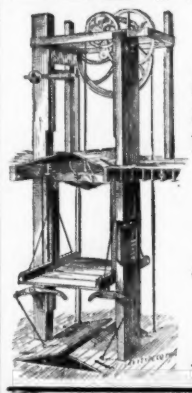

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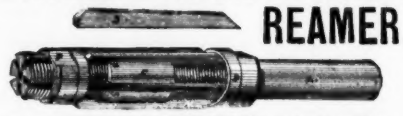

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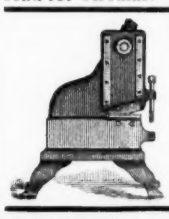

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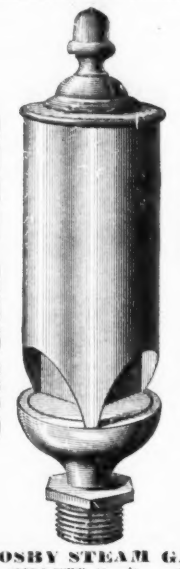

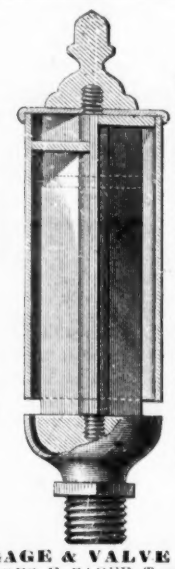

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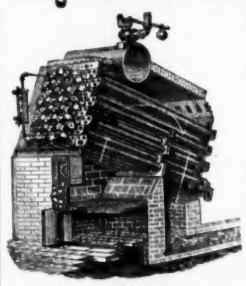

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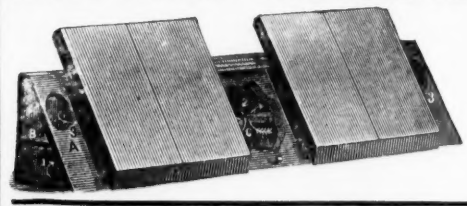

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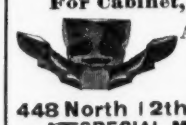

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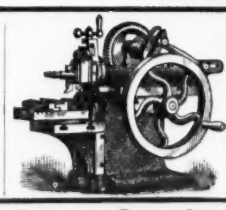

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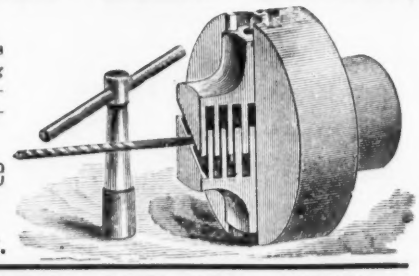

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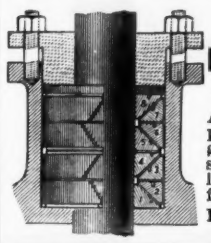

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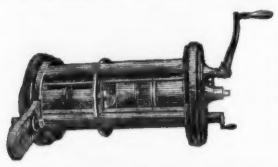

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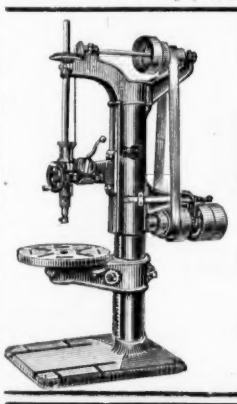

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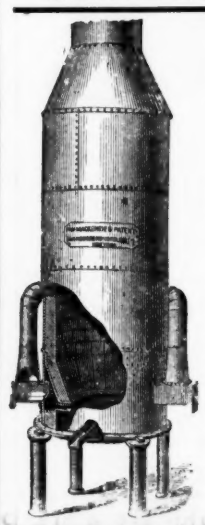

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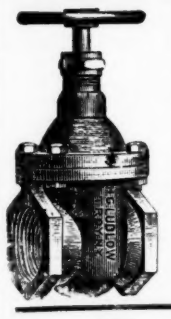

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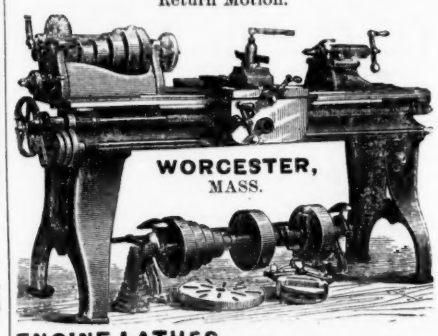

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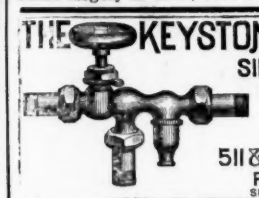

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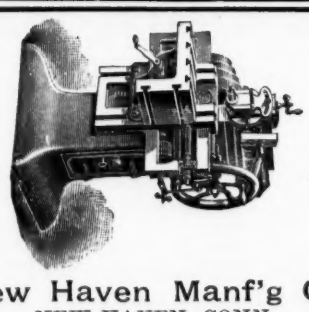

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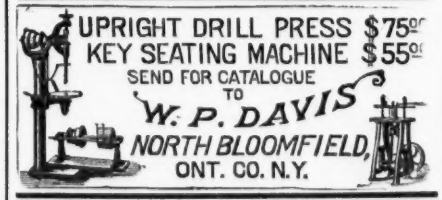

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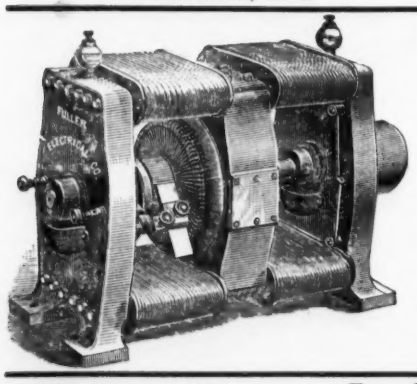

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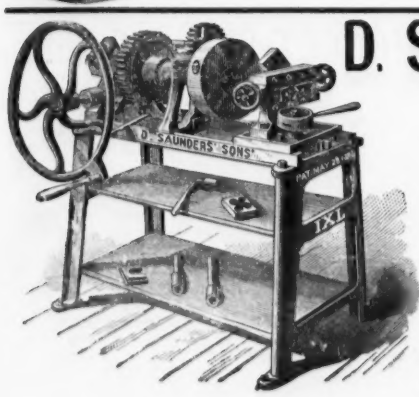

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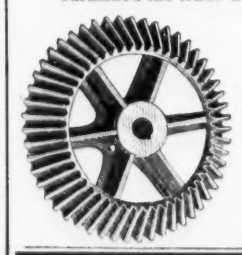

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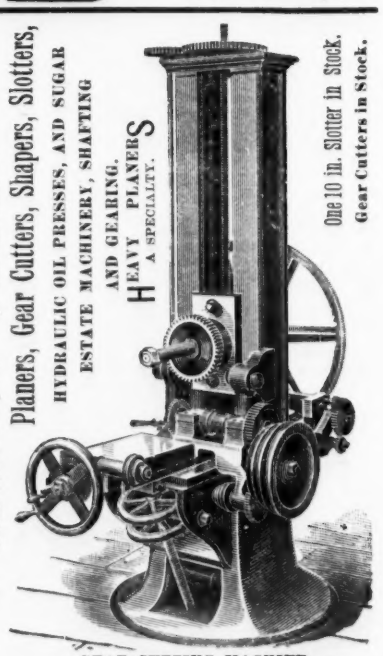

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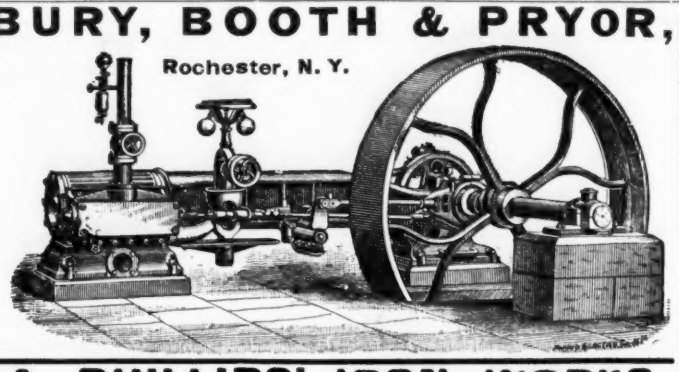

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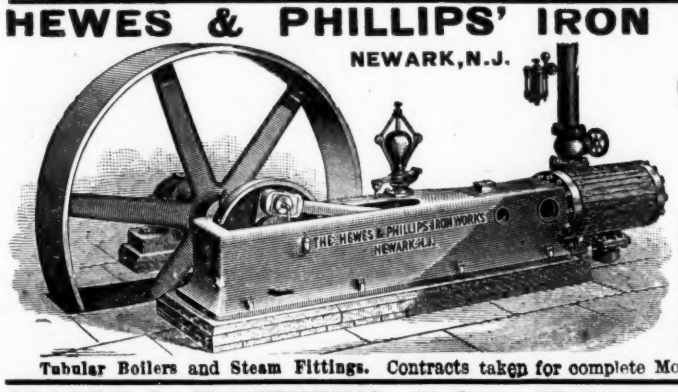

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Two Engine Lathes, 42 in. x 16 ft. Triple Geared. Ames. New. June 1.
One Engine Lathe, 36 in. x 18 ft Fifield. New. Aug. 1
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Two " " Each 24 in. 8ft. x 10ft. -12ft. -14 ft. New. Ames.
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One " " 15 in. x 6 ft. Father's. New.
One " " 15 in. x 6 ft. with Turret. Flathers New.
Two Engine Lathes, 14 in. x 6 ft. Star Tool Co. New.
Six " " 13 in. x 6 ft. Ames. New.
Two " " 13 ft. x 5ft. " "
Six Hand Lathes. 12 in. x 5 ft. Hendey. New.
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One 6 in. Stroke Shaper. Boynton. New.
Two 9 in. Stroke Shapers. Hewes & Phillips.
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One Screw Machine. New Pattern. Wire Feed.
Three 4 Spindle Drills. No. 2. Pratt & Whitney.
One 6 " " " 1. " "
Four 16 in. Upright Drills. Prentiss. New.
One 20 in. Upright Drill. " "
Two 22 in. " " " "
One 24 in. " " Ames. New.
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Full capacity of Planer, 16' long, 36" wide, 36" high. A modern tool and in first-class condition.

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1 " " 18 in. x 8 ft. Lodge & Barker. "
1 " " 24 in. x 12 ft. Fifield. "
1 " " 20 in. x 12 ft. " "
1 " " 26 in. x 12 ft. Lathe & Morse. "
1 " " 30 in. x 16 ft. Perkins. "
1 " " 26 in. x 14 ft. " "
1 " " 16 in. x 6 ft. " "
1 " " 24 in. x 12 ft. Michel. "
1 " " 12 in. x 5 ft. Prentiss. "
1 " " 12 in. x 4 ft. " "
1 19 in. Blaisdell Drill.
1 Hand Lathe 12 in. x 5 ft. Garvin. "
1 Fox " 15 in. x 5 ft. Pike & Dean. "
1 12 in. x 5 ft. Turret Lathe. Lodge & Barker.
1 Planer, 24 in. x 24 in. x 6 ft. Woodman. "
1 20 in. Upright Drill. Prentiss. New.
1 16 in. Upright Drill. Prentiss. New.
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1 10 in. Shaper. Gould. New.
1 Schlenker Bolt Cutter to take sizes from ¼ to 1¼ inches inclusive. New.

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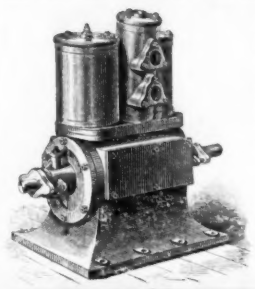

is absolutely balanced at all speeds, and may be run from **300 to 1200 revolutions per minute**. Requires neither **Lining, Adjustment, Keying up, Packing, Lubrication or Wiping.** Skilled Engineers are entirely dispensed with. **Economical, Compact, Self-Contained, Enclosed from Dirt, and Capable of Continuous Runs.** Is especially adapted to direct connection to high-speed machinery; also, for all general purposes of belted power. Workmanship equal to the best machine tools. **All parts built strictly to gauge and interchangeable.**

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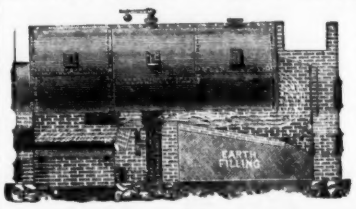
JARVIS PATENT FURNACE FOR SETTING STEAM BOILERS.



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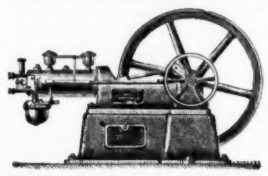

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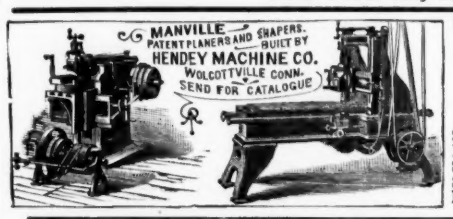

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Manville Patent Iron Planers and Shapers.

15 in. Shapers, 24 in. Shapers, 3½ ft. x 16 in., 5 ft. x 20 in., 6 ft. x 24 in., 8 ft. x 24 in. Planers, Amateurs' Hand Planers, with chuck and centers, Hollow Steel Spindle Hand Lathes, Brass and Wire Slitters, Spring Chuck, and Common Clock Lathes. Catalogue gives many names of users of our tools.

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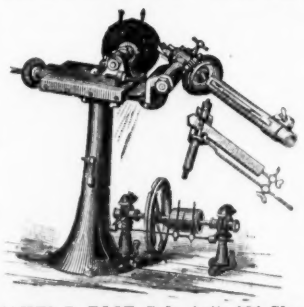

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1 30 in. x 30 in. x 8 ft. Planer New. May.
1 42 in. Swing, 16 ft. bed. New Engine Lathe. June.
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1 36 in. " 12 ft. " " " " "
1 36 in. " 18 ft. " " " " "
2 30 in. swing, 15 ft. bed. Engine Lathes. May.
1 22 in. swing, 13½ ft Bed Engine Lathes. "
5 22 in. x 12 ft. Engine Lathes. May.
3 19 in. swing, 10 ft. Bed Engine Lathes. May.
2 11 in. " 5 ft. " " "
2 30 in. " Upright Back Geared Drills. "
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The following on hand:

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1 26 in. " 10 ft. " " "
2 19 in. " 8 ft. " " "
2 18 in. " 8 ft. " " "
1 18 in. " 8 ft. " " Tilting carriage
1 18 in. " 11 ft. " " "
1 17 in. " 6 ft. " " 2d-hand.
1 14 in. " 4 ft. " " 2d-hand.
1 12 in. " 4 ft. " " New.
2 11 in. " 5 ft. " " "
1 15 in. " 9 ft. Hand Lathe. New.
3 12 in. " 6 ft. " " "
1 10 in. " 4½ ft. Bed Hand Lathe. New.
1 Boring Lathe, 16 ft. bed, 54 in swing.
1 Round Arbor Fox Lathe. Fine order.
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1 26 in. x 6 ft. Iron Planer. 2d-hand.
1 26 in. x 5 ft. Iron Planer. 2d-hand.
1 20 in. x 4 ft. " "
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1 26 in. Drill. B.G.&S.F. New.
1 18 in. Bench Drill.
1 2 Spindle Drill. New.
1 4 " " "
2 Wall Drills, heavy. Second-hand. 60 and 72 in
1 9 in. Shaper. 2d-hand.
1 Index Miller.
2 Milling Machines, Lincoln pattern. Second-hand
1 Manhattan Arms Co. Miller. Second-hand
1 Sellers Milling Machine. 2d-hand.
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1 Pond's Double Milling Machine. 2d-hand.
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1 No. 2 " Wire Feed. New.
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1 Betts, No. 2, Power Punch. New.
4 Double Acting Presses, No. 3, nearly new.
4 Single-Acting Presses, for power, "
100 Foot Presses, nearly new.
1 Medium Power Punching Press. Second hand.
2 Small " " Presses, "
1 Foot Punch, with bench. New.
1 Lot Pistol Machinery. Second-hand.
3 Grind Stones and Frames.
1 Steam Hammer. Cylinder 6½x18. 2d-hand.
Lot of Forges 1 Band Saw, 1 Slat Tenoner, 1 Railway Saw Bench, 1 Foot-power Circular Saw, Cold Rolled Shafting, Pulleys, Hangers, Couplings, &c., always in store.

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NEW MACHINE SHOP TOOLS.

List of Sizes for Quick Delivery.

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16 in.	swing,	6 ft.	bed.	Ames.	(on hand.)		16 in. x 16 in. x 3½ ft.	Parker.
16	"	6	"	Nutter.	Barnes.		22 in. x 20 in. x 4 ft.	Wheeler.
19	"	8	"	Gray.	(on hand.)		22 in. x 20 in. x 4 ft.	Ames.
20	"	10	"	Fifield.	On hand.		22 in. x 22 in. x 6 ft.	Powell.
20	"	12	"	"	"		24 in. x 24 in. x 6 ft.	Ames.
21	"	12	"	Blaisdell.	"		24 in. x 24 in. x 6 ft.	Hendey.
24	"	12	"	"			26 in. x 26 in. x 6 ft.	Gleason
26	"	12	"	Powell.			30 in. x 30 in. x 8 ft.	Fitchburg.
26	"	16	"	"			32 in. x 32 in. x 10 ft.	Gleason.
36	"	16	"	Fitchburg.	(on hand.)		38 in. x 36 in. x 10 ft.	New Haven.

2 No. 2 Cabinet Turret Brass Lathes on hand.
Send for Illustrated Catalogue of Machine Tools.

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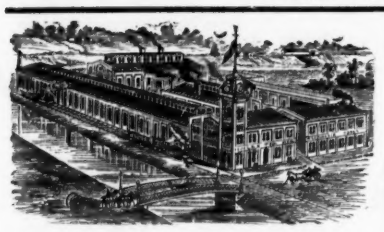

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Every opportunity will here be given the purchaser to acquaint himself with the details of our machinery, and we propose to carry, at this point, as large a stock as the condition of trade will admit.

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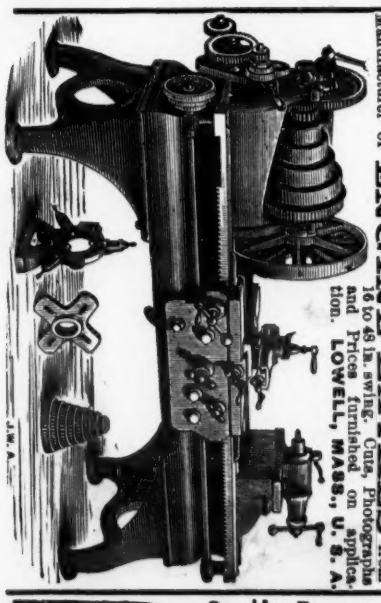

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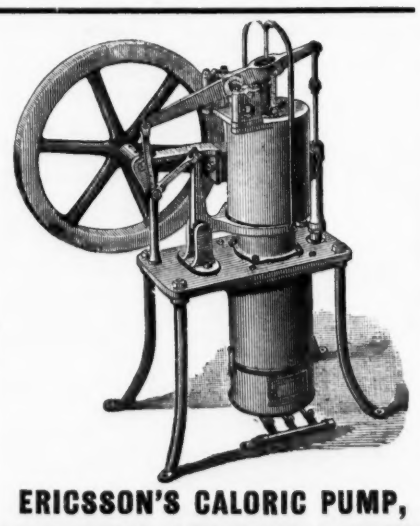

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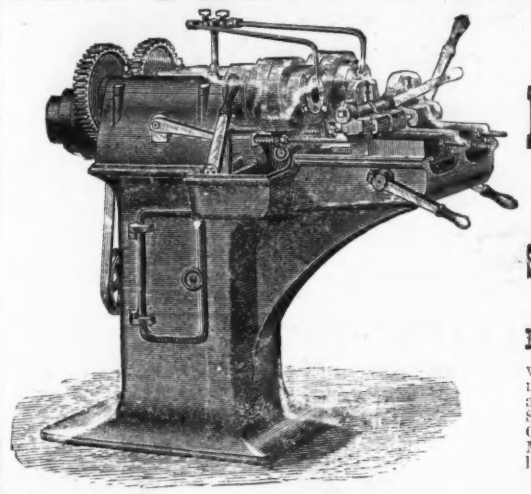

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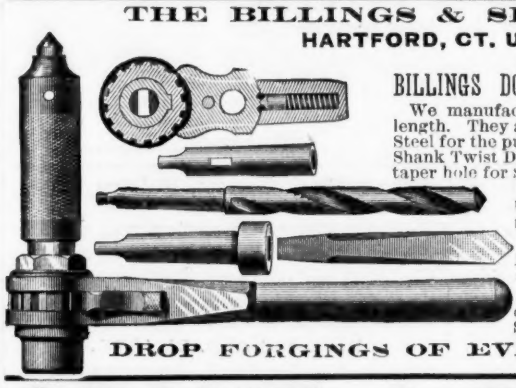

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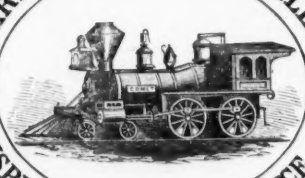

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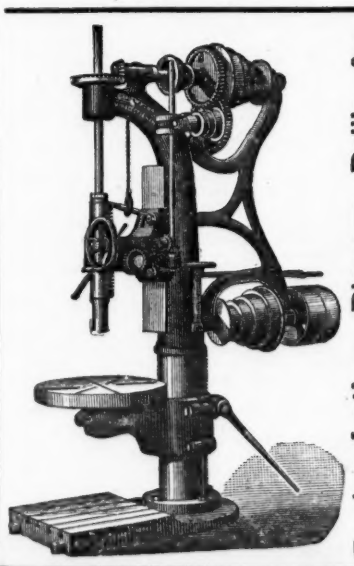

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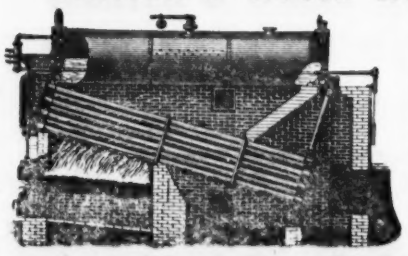

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